About This Guide

This section discusses the objectives, audience, organization, and conventions of this hardware installation and configuration guide.

Objectives

This publication will step you through the initial site preparation and installation of the router. Troubleshooting, maintenance procedures, and cable specifications are also provided.

Although minimum software configuration information is provided, it is not meant as comprehensive router configuration instructions. For detailed software configuration information, refer to the Cisco IOS configuration guide and command reference publications. These publications are available on the documentation CD that came with your router or you can order printed copies. Refer to the “Ordering Documentation” section in the “Overview of the Router” chapter for ordering information.

This publication describes a variety of router models that are similar in functionality, but differ in the number of interfaces supported. Some information provided may not apply to your particular router model.

Audience

This publication is designed for the person installing the router, who should be familiar with electronic circuitry and wiring practices and have experience as an electronic or electromechanical technician.

Organization

The major sections of this hardware installation and configuration guide are as follows:

- Chapter 1, “Overview of the Router,” discusses the features and specifications of the routers, and describes how to obtain technical support and order documentation.
- Chapter 2, “Preparing to Install the Router,” discusses environmental requirements, safety recommendations, and describes the various ports and how to prepare for connections between networks and ports.
- Chapter 3, “Installing the Router,” includes basic installation information and discusses making connections to your LAN, WAN, and console terminal.
- Chapter 4, “Configuring the Router,” discusses how to configure your router using the prompt-driven System Configuration Dialog, configuration mode, or AutoInstall. This chapter also provides some basic information about how to use the Cisco IOS software.
- Appendix A, “Troubleshooting the Router,” discusses how to isolate problems and read the LEDs.
- Appendix B, “Maintaining the Router,” discusses selected maintenance procedures.
- Appendix C, “Cable Specifications,” provides pinouts for the router ports and cables.

Conventions

This publication uses the following conventions to convey instructions and information.

Command descriptions use these conventions:

- Commands and keywords are in **boldface** font.
- Variables for which you supply values are in *italic* font.
- Elements in square brackets ([ ]) are optional.
- Alternative but required keywords are grouped in braces ({ }) and are separated by vertical bars (|).

Examples use these conventions:

- Terminal sessions and information the system displays are in `screen` font.
- Information you enter is in **`boldface screen`** font.
- Nonprinting characters are in angle brackets (< >).
- Default responses to system prompts are in square brackets ([ ]).

Note Means *reader take note*. Notes contain helpful suggestions or references to materials not contained in this manual.

Timesaver Means *the described action saves time*. You can save time by performing the action described in the paragraph.

Caution Means r*eader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning This warning symbol means *danger.* You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and familiar with standard practices for preventing accidents. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

CHAPTER 1

Overview of the Router

Table 1-1 lists the router models discussed in this publication and provides a summary of the interfaces supported on each model. These router models are similar in functionality, but differ in the number of interfaces supported.

Table 1-1 Summary of Router Interfaces

Model	Ethernet AUI[1] (DB-15)	Token Ring (DB-9)	Serial (DB-60)	ISDN[2] BRI[3] (RJ-45)
Cisco 2501/ CPA2501	1	–	2	–
Cisco 2502/ CPA2502	–	1	2	–
Cisco 2503/ CPA2503	1	–	2	1
Cisco 2504/ CPA2504	–	1	2	1
Cisco 2513/ CPA2513	1	1	2	–
Cisco 2514/ CPA2514	2	–	2	–
Cisco 2515[4]	–	2	2	–

1. AUI = attachment unit interface.
2. ISDN = Integrated Services Digital Network.
3. BRI = Basic Rate Interface.
4. A CPA2515 model is not available.

Note Throughout the remainder of the publication, one model number will be used in text references. For example, references to the model 2501 router will apply to both the Cisco 2501 and CPA2501 routers.

Hardware Features

In addition to the interfaces listed in Table 1-1, the routers include the following hardware features:

- Dynamic random-access memory (DRAM) for main memory and shared memory
- Nonvolatile random-access memory (NVRAM) for storing configuration information
- Flash memory for running the Cisco IOS software
- EIA/TIA-232 console port for local system access using a console terminal
- EIA/TIA-232 auxiliary port for remote system access using a modem

Note EIA/TIA-232 and EIA/TIA-449 were known as recommended standards RS-232 and RS-449 before their acceptance as standards by the Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA).

Figure 1-1 to Figure 1-7 show the rear panels of the router models discussed in this publication.

Figure 1-1 Model 2501 Router Rear Panel

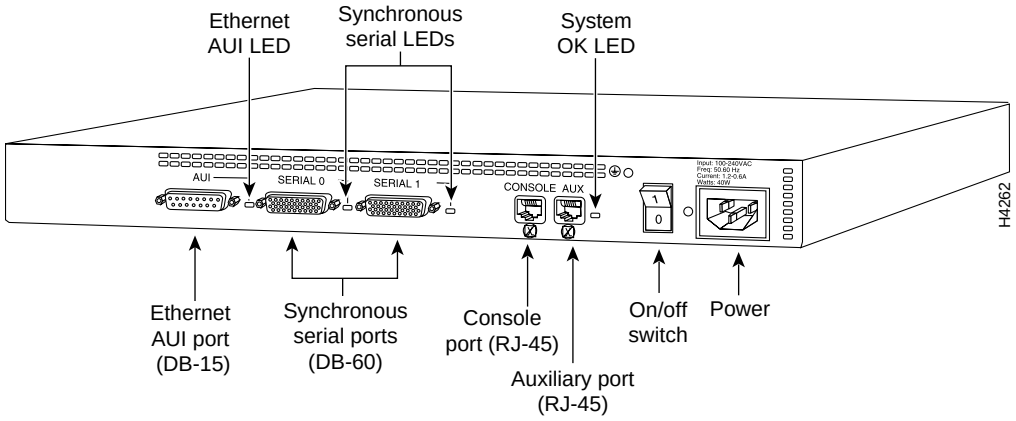


Figure 1-2 Model 2502 Router Rear Panel

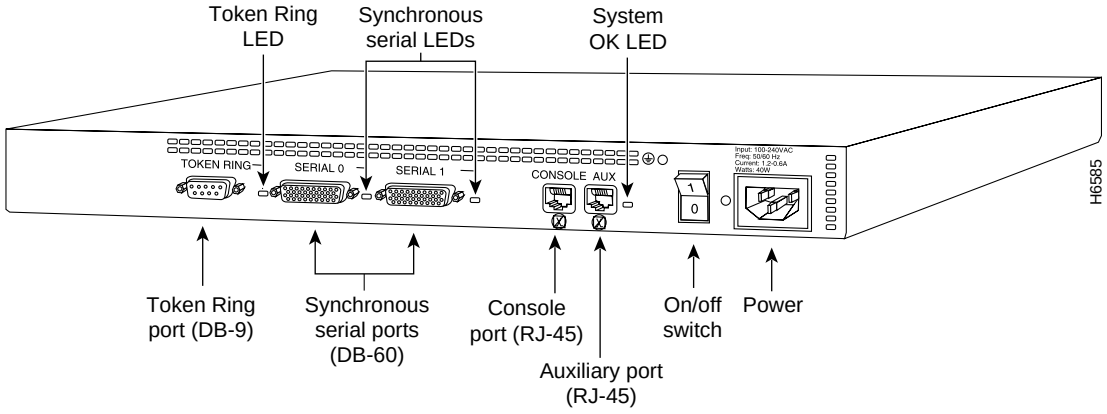


Figure 1-3 Model 2503 Router Rear Panel

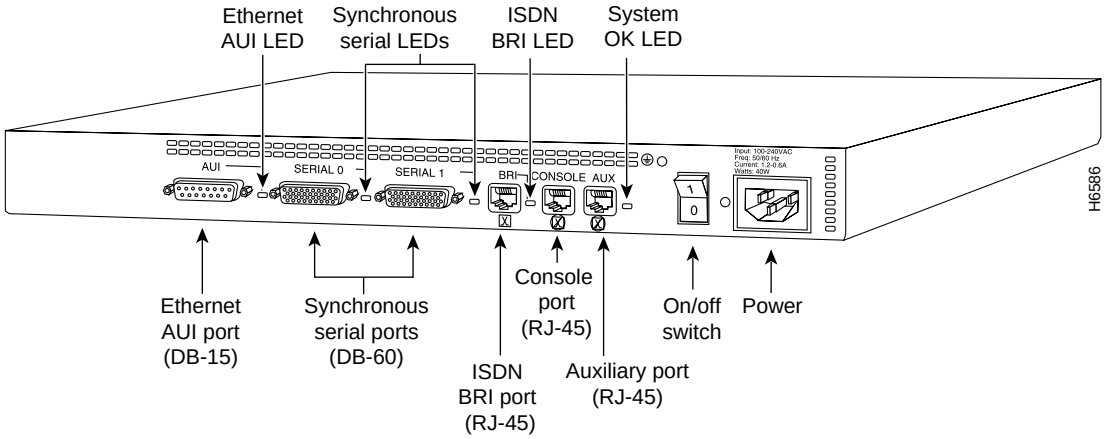


Figure 1-4 Model 2504 Router Rear Panel

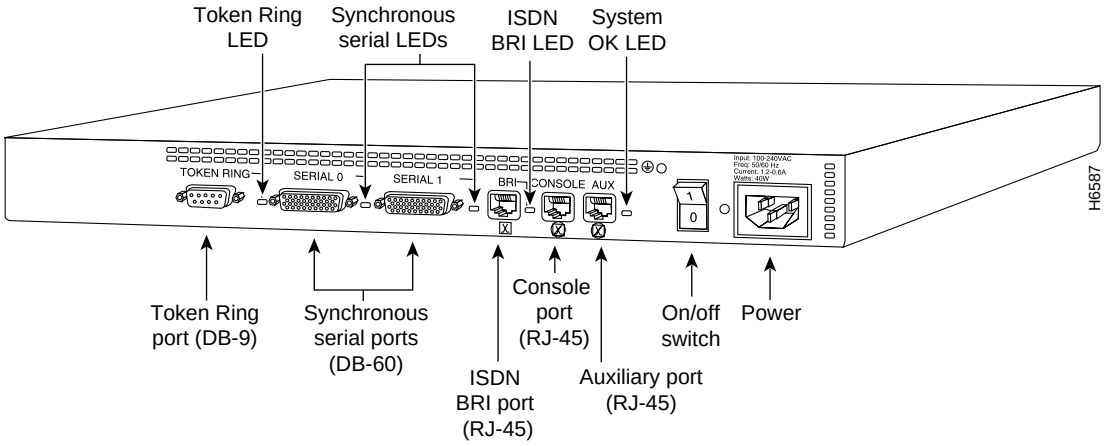


Figure 1-5 Model 2513 Router Rear Panel

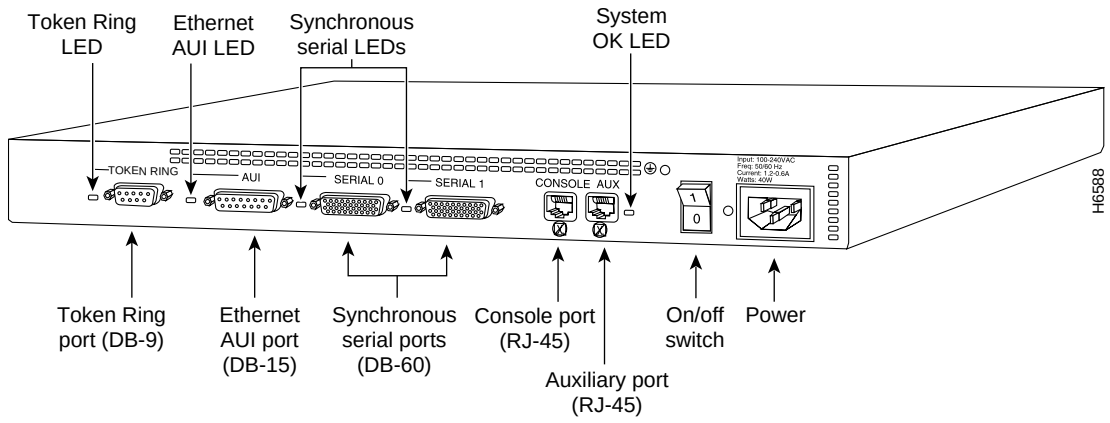


Figure 1-6 Model 2514 Router Rear Panel

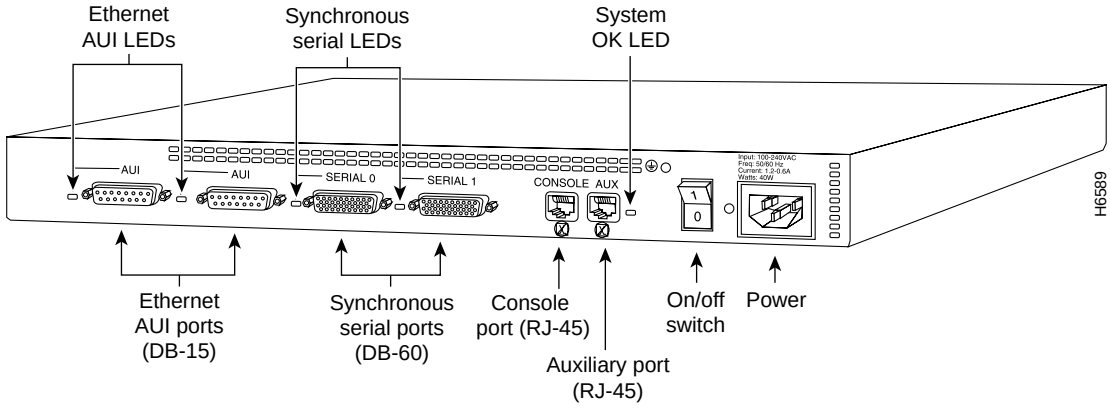
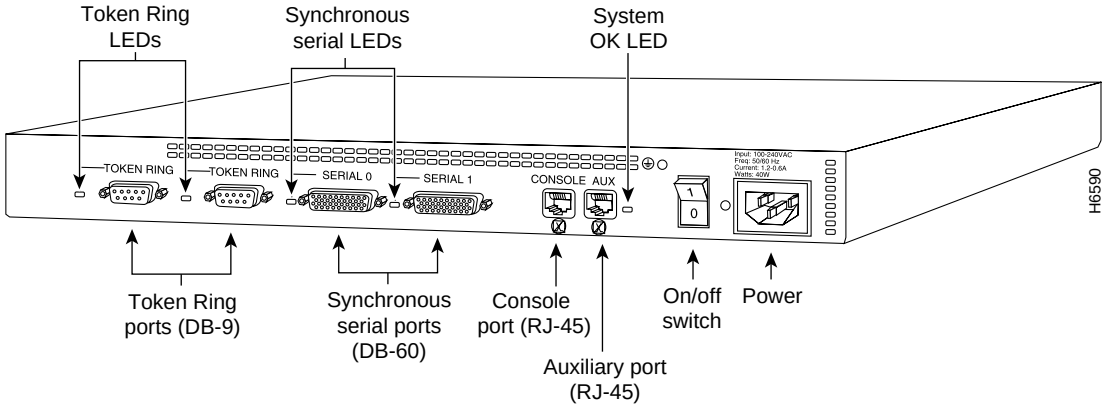


Figure 1-7 Model 2515 Router Rear Panel



System Specifications

The system specifications of the routers are listed in Table 1-2.

Table 1-2 System Specifications

Description	Specification
Dimensions (H x W x D)	1.75 x 17.5 x 10.56 in. (4.44 x 44.45 x 26.82 cm), one rack unit
Weight	10 lb (4.5 kg)
Input voltage, AC power supply Current Frequency Power dissipation	100 to 240 VAC 1.2 to 0.6A 50/60 Hz 40W (maximum), 135.5 Btus[1]/hr
Input voltage, DC power supply Current Power dissipation	40W, 40 to 72 VDC 1.5 to 1.0A 40W (maximum), 135.5 Btus/hr
Processor	20-MHz Motorola 68EC030

Table 1-2 System Specifications (Continued)

Description	Specification
Interfaces	See Table 1-1 for a list of interfaces supported on each router model. • Ethernet AUI (IEEE[2] 802.3) (DB-15) • Token Ring (IEEE 802.5) (DB-9) • Synchronous serial[3] (DB-60) • ISDN BRI (RJ-45)[4] • Console (RJ-45) • Auxiliary (RJ-45)
Operating environment	32 to 104°F (0 to 40°C)
Nonoperating temperature	–40 to 185°F (–40 to 85°C)
Operating humidity	5 to 95%, noncondensing
Noise level	34 dBa @ 3 ft (0.914 m)
Regulatory compliance	FCC Class A and Canadian DOC Class A For more regulatory information, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.

1. Btus = British thermal units.
2. IEEE = Institute of Electrical and Electronic Engineers.
3. The synchronous serial interface supports the following standards in data terminal equipment (DTE) and data communications equipment (DCE) mode: EIA/TIA-232, EIA/TIA-449, V.35, and X.21. The EIA-530 standard is supported in DTE mode only.
4. External network terminal 1 (NT1) device required.

Obtaining Service and Support

For service and support for a product purchased from a reseller, contact the reseller. Resellers offer a wide variety of Cisco service and support programs, which are described in the information packet that shipped with your chassis.

Note If you purchased your product from a reseller, you can access Cisco Connection Online (CCO) as a guest. CCO is Cisco Systems' primary, real-time support channel.Your reseller offers programs that include direct access to CCO's services.

For service and support for a product purchased directly from Cisco, use CCO.

Cisco Connection Online

CCO is Cisco Systems' primary, real-time support channel. SMARTnet customers and partners can self-register on CCO to obtain additional content and services.

Available 24 hours a day, 7 days a week, CCO provides a wealth of standard and value-added services to Cisco's customers and business partners. CCO services include product information, software updates, release notes, technical tips, the Bug Navigator, configuration notes, brochures, descriptions of service offerings, and download access to public and authorized files.

CCO serves a wide variety of users through two interfaces that are updated and enhanced simultaneously—a character-based version and a multimedia version that resides on the World Wide Web (WWW). The character-based CCO supports Zmodem, Kermit, Xmodem, FTP, and Internet e-mail, and is excellent for quick access to information over lower bandwidths. The WWW version of CCO provides richly formatted documents with photographs, figures, graphics, and video, as well as hyperlinks to related information.

You can access CCO in the following ways:

- WWW: http://www.cisco.com.
- WWW: http://www-europe.cisco.com.
- WWW: http://www-china.cisco.com.
- Telnet: cco.cisco.com.
- Modem: From North America, 408 526-8070; from Europe, 33 1 64 46 40 82. Use the following terminal settings: VT100 emulation; databits: 8; parity: none; stop bits: 1; and baud rates up to 14.4 kbps.

For a copy of CCO's Frequently Asked Questions (FAQ), contact cco-help@cisco.com. For additional information, contact cco-team@cisco.com.

Note If you need technical assistance with a Cisco product that is under warranty or covered by a Cisco maintenance contract, contact Cisco's Technical Assistance Center (TAC) at 800 553-2447, 408 526-7209, or tac@cisco.com.

Please use CCO to obtain general information about Cisco Systems, Cisco products, or upgrades. If CCO is not accessible, contact 800 553-6387, 408 526-7208, or cs-rep@cisco.com.

Ordering Documentation

Documentation for Cisco products is available in three forms: on a CD-ROM, printed books, and on the World Wide Web. You have the option of subscribing to the documentation CD through an update service. Or you can order printed documentation at an additional cost. Refer to the information packet included with the router for detailed ordering information. You can also access Cisco documentation on the World Wide Web URL http://www.cisco.com.

CHAPTER 2

Preparing to Install the Router

This chapter describes important information to consider before you begin to install the router, and includes the following sections:

- Safety Recommendations
- General Site Requirements
- Preparing to Connect to a Network
- Where to Go Next

Safety Recommendations

Follow these guidelines to ensure general safety:

- Keep the chassis area clear and dust-free during and after installation.
- Put the removed chassis cover in a safe place.
- Keep tools away from walk areas where you and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.
- Wear safety glasses if you are working under any conditions that might be hazardous to your eyes.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.

Warning Ultimate disposal of this product should be handled according to all national laws and regulations. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Maintaining Safety with Electricity

Follow these guidelines when working on equipment powered by electricity.

Warning Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or can weld the metal object to the terminals. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

- Locate the emergency power OFF switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to turn OFF the power.
- Power OFF the router and unplug the power cord before doing the following:
  - Installing or removing a chassis
  - Working near power supplies

Warning Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Warning Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is OFF and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.

Warning Read the installation instructions before you connect the system to its power source. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, frayed power cords, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn OFF power to the system.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Always follow ESD-prevention procedures when removing and replacing components. Ensure that the chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground. To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

Caution For safety, periodically check the resistance value of the antistatic strap, which should be between 1 to 10 megohms (Mohms).

General Site Requirements

This section describes the requirements your site must meet for safe installation and operation of your system. Ensure that your site is properly prepared before beginning installation.

Site Environment

The router can be placed on a desktop or mounted in a rack or on a wall. The location of the chassis and the layout of your equipment rack or wiring room are extremely important for proper system operation. Equipment placed too close together, inadequate ventilation, and inaccessible panels can cause system malfunctions and shutdowns, and can make system maintenance difficult.

When planning your site layout and equipment locations, remember the precautions described in the next section, “Preventive Site Configuration” to help avoid equipment failures and reduce the possibility of environmentally caused shutdowns. If you are experiencing shutdowns or unusually high errors with your existing equipment, these precautions may help you isolate the cause of failures and prevent future problems.

Preventive Site Configuration

The following precautions will help you plan an acceptable operating environment for your router and will help you avoid environmentally caused equipment failures.

- Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate your system has adequate air circulation.
- Always follow the ESD-prevention procedures described in the section “Preventing Electrostatic Discharge Damage” earlier in this chapter to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.

- Ensure that the chassis cover is secure. The chassis is designed to allow cooling air to flow effectively within it. An open chassis allows air leaks, which may interrupt and redirect the flow of cooling air from internal components.

Configuring Equipment Racks

The following information will help you plan an acceptable equipment rack configuration.

- Enclosed racks must have adequate ventilation. Ensure that the rack is not overly congested because each unit generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air.
- When mounting a chassis in an open rack, ensure that the rack frame does not block the intake or the exhaust ports. If the chassis is installed on slides, check the position of the chassis when it is seated all the way into the rack.
- In an enclosed rack with a ventilation fan in the top, excessive heat generated by equipment near the bottom of the rack can be drawn upward and into the intake ports of the equipment above it in the rack. Ensure that you provide adequate ventilation for equipment at the bottom of the rack.
- Baffles can help to isolate exhaust air from intake air, which also helps to draw cooling air through the chassis. The best placement of the baffles depends on the airflow patterns in the rack, which are found by experimenting with different arrangements.

Power Supply Considerations

Check the power at your site to ensure that you are receiving “clean” power (free of spikes and noise). Install a power conditioner if necessary.

Warning The device is designed to work with TN power systems. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

The router power supply includes the following features:

- Autoselects either 110V or 220V operation.
- All units include a 6-foot (1.8-meter) electrical power cord. (A label near the power cord indicates the correct voltage, frequency, current draw, and power dissipation for the unit.)

Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors). (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Preparing to Connect to a Network

When setting up your router, consider distance limitations and potential electromagnetic interference (EMI) as defined by the EIA.

Warning The Ethernet, Token Ring, serial, console, and auxiliary ports contain safety extra-low voltage (SELV) circuits. BRI circuits are treated like telephone-network voltage (TNV) circuits. Avoid connecting SELV circuits to TNV circuits. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

ISDN Connections

Use a BRI cable (not included) to connect the router directly to an ISDN. (See Table 2-1.)

Warning Network hazardous voltages are present in the BRI cable. If you detach the BRI cable, detach the end away from the router first to avoid possible electric shock. Network hazardous voltages also are present on the system card in the area of the BRI port (RJ-45 connector), regardless of when power is turned OFF. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Warning The ISDN connection is regarded as a source of voltage that should be inaccessible to user contact. Do not attempt to tamper with or open any public telephone operator (PTO)-provided equipment or connection hardware. Any hardwired connection (other than by a nonremovable, connect-one-time-only plug) must be made only by PTO staff or suitably trained engineers. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Table 2-1 lists the specifications for ISDN BRI cables. Refer to the section “ISDN BRI Port and Cable Pinouts” in the appendix “Cable Specifications” for pinouts.

Table 2-1 ISDN BRI Cable Specifications

Specification	High-Capacitance Cable	Low-Capacitance Cable
Resistance (at 96 kHz)	160 ohms/km	160 ohms/km
Capacitance (at 1 kHz)	120 nF[1]/km	30 nF/km
Impedance (96 kHz)	75 ohms	150 ohms
Wire diameter	0.024 in. (0.6 mm)	0.024 in. (0.6 mm)
Distance limitation	32.8 ft (10 m)	32.8 ft (10 m)

1. nF = nanoFarad.

Synchronous Serial Connections

Before you connect a device to the synchronous serial port (labeled “SERIAL”), you will need to know the following:

- The type of device, DTE or DCE, you are connecting to the synchronous serial interface.
- The type of connector, male or female, required to connect to the device.
- The signaling standard required by the device.

DTE or DCE

A device that communicates over a synchronous serial interface is either a DTE or DCE device. A DCE device provides a clock signal that paces the communications between the device and the router. A DTE device does not provide a clock signal. DTE devices usually connect to DCE devices. The documentation that came with the device should indicate whether it is a DTE or DCE device. (Some devices have a jumper to select either mode.) If you cannot find the information in the documentation, refer to Table 2-2 to help you select the proper device type.

Table 2-2 Typical DTE and DCE Devices

Device Type	Gender	Typical Devices
DTE	Male[1]	Terminal
		PC
		Router
DCE	Female[2]	Modem
		CSU/DSU[3]
		Multiplexer

1. If pins protrude from the base of the connector, the connector is male.
2. If the connector has holes to accept pins, the connector is female.
3. CSU/DSU = Channel service unit/data service unit.

Speed and Distance Limitations

Serial signals can travel a limited distance at any given bit rate; generally, the slower the data rate, the greater the distance. All serial signals are subject to distance limits, beyond which a signal degrades significantly or is completely lost.

Table 2-3 lists the maximum speeds and distances for EIA/TIA-232 signals. This signaling standard supports unbalanced circuits at signal speeds up to 64 kbps.

Table 2-3 EIA/TIA-232 Speed and Distance Limitations

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
2400	200	60
4800	100	30
9600	50	15
19200	50	15
38400	50	15
64000	25	7.6

Balanced drivers allow EIA/TIA-449 signals to travel greater distances than the EIA/TIA-232 signals. Table 2-4 lists the maximum speeds and distances for EIA/TIA-449, V.35, X.21, and EIA-530 signals.

Table 2-4 EIA/TIA-449, V.35, X.21, and EIA-530 Speed and Distance Limitations

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
2400	4,100	1,250
4800	2,050	625
9600	1,025	312
19200	513	156

Table 2-4 EIA/TIA-449, V.35, X.21, and EIA-530 Speed and Distance Limitations (Continued)

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
38400	256	78
56000	102	31

Caution The EIA/TIA-449 and V.35 interfaces support data rates up to 2.048 Mbps. Exceeding this maximum could result in loss of data and is not recommended.

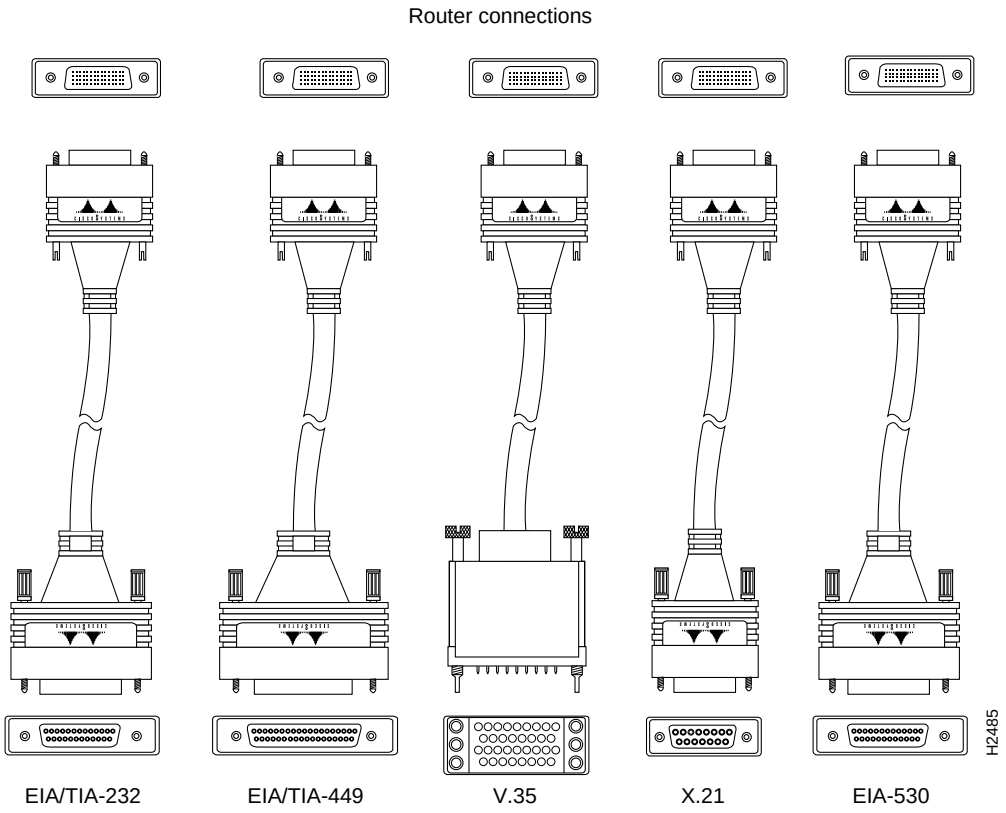
Signaling Standards

The synchronous serial port supports the following signaling standards: EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530. You can order a DB-60 shielded serial transition cable that has the appropriate connector for the standard you specify. The router end of the shielded serial transition cable has a DB-60 connector, which connects to the serial port on the rear panel of the router. The other end of the serial transition cable is available with the connector appropriate for the standard you specify. The documentation for the device you want to connect should indicate the standard used for that device. The synchronous serial port can be configured as DTE or DCE (except EIA-530, which is DTE only), depending on the attached cable.

Note All serial ports configured as DTE require external clocking from a CSU/DSU or other DCE device.

Figure 2-1 shows the serial transition cables you can connect to the serial port on the rear panel of the router.

Figure 2-1 Serial Transition Cables



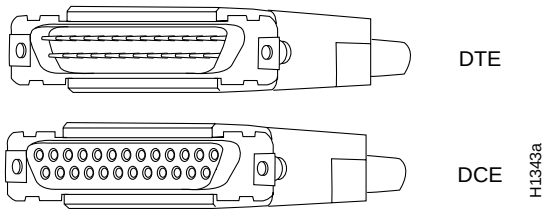
Although attempting to manufacture your own serial cables is not recommended (because of the small size of the pins on the DB-60 serial connector), cable pinouts are provided in the appendix “Cable Specifications.” To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

EIA/TIA-232 Connections

The EIA/TIA-232 standard supports unbalanced circuits at signal speeds up to 64 kbps. The serial port (labeled “SERIAL”) supports *synchronous* connections. The console and auxiliary ports also use an EIA/TIA-232 connection; however, the console and auxiliary ports support *asynchronous* connections.

The network end of the EIA/TIA-232 serial transition cable (not included) provides a DB-25 connector, as shown in Figure 2-2. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. EIA/TIA-232 serial transition cables are available with a DB-25 plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-2 EIA/TIA-232 Serial Transition Cable Connectors, Network End



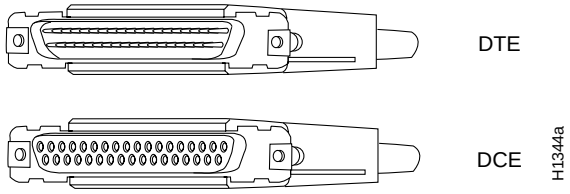
EIA/TIA-449 Connections

The EIA/TIA-449 standard, which supports balanced and unbalanced transmissions, is a faster (up to 2 Mbps) version of the EIA/TIA-232 standard that provides more functions and supports transmissions over greater distances.

The EIA/TIA-449 standard was intended to replace the EIA/TIA-232 standard, but it was not widely adopted primarily because of the large installed base of DB-25 hardware and because of the larger size of the 37-pin EIA/TIA-449 connectors, which limited the number of connections possible (fewer than possible with the smaller, 25-pin EIA/TIA-232 connector).

The network end of the EIA/TIA-449 serial transition cable (not included) provides a DB-37 connector, as shown in Figure 2-3. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. EIA/TIA-449 serial transition cables are available with a DB-37 plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-3 EIA/TIA-449 Serial Transition Cable Connectors, Network End

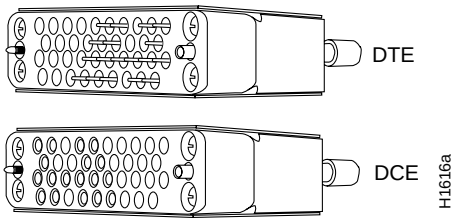


V.35 Connections

The V.35 standard is recommended for speeds up to 48 kbps, although in practice it is used successfully at 4 Mbps.

The network end of the V.35 serial transition cable (not included) provides a standard 34-pin Winchester-type connector, as shown in Figure 2-4. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. V.35 cables are available with a standard V.35 plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-4 V.35 Serial Transition Cable Connectors, Network End

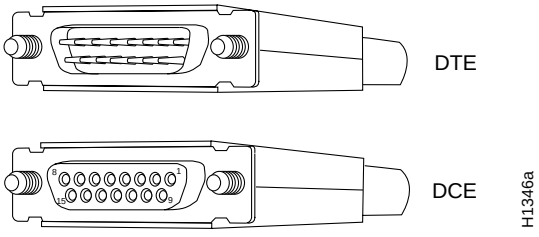


X.21 Connections

The X.21 connector uses a 15-pin connector for balanced circuits and is commonly used in the United Kingdom to connect to the public data network. X.21 relocates some of the logic functions to the DTE and DCE interfaces and, as a result, requires fewer circuits and a smaller connector than EIA/TIA-232.

The network end of the X.21 serial transition cable (not included) is a standard DB-15 connector, as shown in Figure 2-5. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. X.21 cables are available with a plug or receptacle in either DTE or DCE mode. To order a cable, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure 2-5 X.21 Serial Transition Cable Connectors, Network End

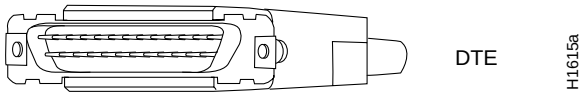


EIA-530 Connections

The EIA-530 standard, which supports balanced transmission, provides the increased functionality, speed, and distance of EIA/TIA-449 on the smaller, DB-25 connector used for EIA/TIA-232, instead of the 37-pin connector used for EIA/TIA-449. Like EIA-TIA-449, EIA-530 refers to the electrical specifications of EIA/TIA-422 and EIA/TIA-423. Although the specification recommends a maximum speed of 2 Mbps, EIA-530 is used successfully at 4 Mbps or faster speeds over short distances.

The EIA/530 serial transition cable (not included) is available in DTE mode only. The network end of the EIA-530 adapter cable is a standard DB-25 plug commonly used for EIA/TIA-232 connections, as shown in Figure 2-6. The end that connects to the serial port on the rear panel of the router has a DB-60 connector. To order a cable, refer to the section "Obtaining Service and Support" in the "Overview of the Router" chapter.

Figure 2-6 EIA-530 Serial Transition Cable Connector, Network End



Ethernet Connections

The IEEE has established Ethernet as standard 802.3. The most common Ethernet implementations are as follows:

- 10Base5 (AUI)—Ethernet on thick coaxial cable, also known as thick Ethernet. The maximum segment distance is 1,640 feet (500 meters).
- 10Base2 (Thinnet)—Ethernet on thin coaxial cable, also known as thin Ethernet. The maximum segment distance is 607 feet (185 meters).
- 10BaseT—Ethernet on unshielded twisted-pair (UTP) cable. The maximum segment distance is 328 feet (100 meters). UTP cables look like the cables used for ordinary telephones; however, UTP cables meet certain electrical standards that telephone cables do not.

Ethernet model routers include an Ethernet AUI interface, which operates at speeds up to 10 Mbps.

The cables and transceivers required to connect the router to an Ethernet network are not included. For ordering information, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Token Ring Connections

The IEEE has established Token Ring as standard 802.5. The distance limitations for the IEEE 802.5 specification indicate a maximum segment distance of 328 feet (100 meters) for UTP cabling. The distance limitation is 1,640 feet (500 meters) for shielded twisted-pair (STP) cabling.

Token Ring can operate at two different ring speeds: 4 and 16 Mbps. All devices on the ring must agree on the operating speed.

Use a Token Ring lobe cable to connect the router to a media attachment unit (MAU). The lobe cable and MAU are not included with the router. Refer to the section “Token Ring Port Pinouts” in the appendix “Cable Specifications” for the Token Ring port pinouts.

Console and Auxiliary Port Connections

Your router includes an asynchronous serial console and an auxiliary port. The console and auxiliary ports provide access to the router either locally (with a console terminal) or remotely (with a modem). This section discusses important cabling information to consider before connecting a console terminal (an ASCII terminal or PC running terminal emulation software) to the console port or modem to the auxiliary port.

The main difference between the console and auxiliary ports is that the auxiliary port supports hardware flow control and the console port does not. Flow control paces the transmission of data between a sending device and a receiving device. Flow control ensures that the receiving device can absorb the data sent to it before the sending device sends more. When the buffers on the receiving device are full, a message is sent to the sending device to suspend transmission until the data in the buffers has been processed. Because the auxiliary port supports flow control, it is ideal for use with the high-speed transmissions of a modem. Console terminals transmit at slower speeds than modems; therefore, the console port is ideal for use with console terminals.

Console Port Connections

Your router includes an EIA/TIA-232 asynchronous serial console port (RJ-45). Cables and adapters to connect a console terminal (an ASCII terminal or PC running terminal emulation software) to the console port are included. To connect an ASCII terminal to the console port, use the RJ-45-to-RJ-45 roll-over cable (looks like a telephone cable) with the female RJ-45-to-DB-25 adapter (labeled “TERMINAL”). To connect a PC running terminal emulation software to the console port, use the RJ-45-to-RJ-45 roll-over cable with the female RJ-45-to-DB-9 adapter (labeled “TERMINAL”). The default parameters for the console port are 9600 baud, 8 data bits, no parity, and 2 stop bits. The console port does not support hardware flow control. For detailed information about installing a console terminal, see the section “Connecting to the Console Port” in the chapter “Installing the Router.” See the appendix “Cable Specifications” for cable and port pinouts.

Auxiliary Port Connections

Your router includes an EIA/TIA-232 asynchronous serial auxiliary port (RJ-45) that supports hardware flow control. A cable and an adapter to connect a modem to the auxiliary port are included. To connect a modem to the auxiliary port, use the RJ-45-to-RJ-45 roll-over cable (looks like a telephone cable) with the male RJ-45-to-DB-25 adapter (labeled “MODEM”). For detailed information about connecting devices to the auxiliary port, see the section “Connecting a Modem to the Auxiliary Port” in the chapter “Installing the Router.” See the appendix “Cable Specifications” for cable and port pinouts.

Where to Go Next

Proceed to the next chapter, “Installing the Router,” for installation instructions.

CHAPTER 3

Installing the Router

This chapter guides you through the installation of the routers and includes the following sections:

- Required Tools and Equipment
- Setting Up the Chassis
- Connecting the DC Power Supply
- Connecting to a Network
- Connecting the Console Terminal and Modem
- What to Do after Installing the Router Hardware

Warning Only trained and qualified personnel should be allowed to install or replace this equipment. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Required Tools and Equipment

Installation requires some tools and equipment that are not provided as standard equipment with the router. Following are the tools and parts required to install the router:

- Flat-blade screwdrivers: small, 3/16-inch (0.476 cm) and medium, 1/4-inch (0.625 cm).
- ESD-preventive wrist strap.
- Screws to secure the rack-mount brackets to the router.
- Cables for connection to the WAN and LAN ports:
  - Ethernet AUI cable or Ethernet transceiver for connection to the Ethernet AUI port.
  - Token Ring lobe cable for connection to the Token Ring port.
  - Serial transition cable for connection to the synchronous serial port .
  - Cable for connection to the ISDN BRI port.

Note For cable ordering information, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

- Ethernet 10BaseT hub or PC with a network interface card for connection to the Ethernet AUI (LAN) port.
- Token Ring MAU for connection to the Token Ring (LAN) port.
- CSU/DSU or other DCE device for connection to the synchronous serial interface.
- NT1 device for ISDN BRI WAN connections, if not supplied by your service provider.
- Console terminal (an ASCII terminal or a PC running terminal emulation software) configured for 9600 baud, 8 data bits, no parity, and 2 stop bits. A terminal is required unless you are using the AutoInstall procedure. See the section “Connecting the Console Terminal and Modem” later in this chapter for instructions on connecting a console terminal.
- Modem for connection to the auxiliary port for remote administrative access (optional).

Setting Up the Chassis

You can set the chassis on a desktop, install it in a rack, or mount it on a wall or other flat surface. Use the procedure in this section that best meets the needs of your network. The sections are as follows:

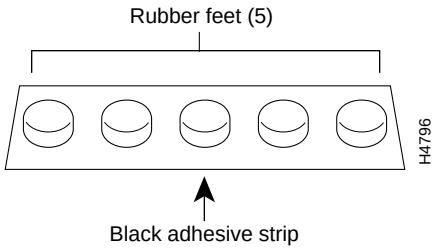
- Setting the Chassis on a Desktop
- Rack-Mounting the Chassis
- Wall-Mounting the Chassis

Setting the Chassis on a Desktop

Before setting the router on a desktop, shelf, or other flat, secure surface, perform the following steps to install the rubber feet:

Step 1 Locate the rubber feet on the black adhesive strip that shipped with the chassis. (See Figure 3-1.)

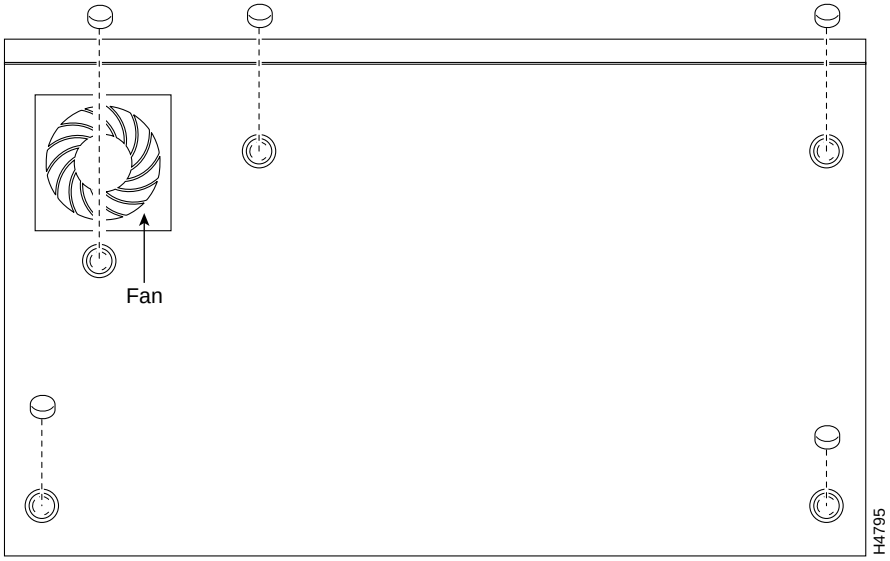
Figure 3-1 Identifying the Rubber Feet



Step 2 Place the router upside down on a smooth, flat surface.

Step 3 Peel off the rubber feet from the black adhesive strip and place them adhesive-side down onto the five round, recessed areas on the bottom of the chassis. (See Figure 3-2.)

Figure 3-2 Installing the Rubber Feet



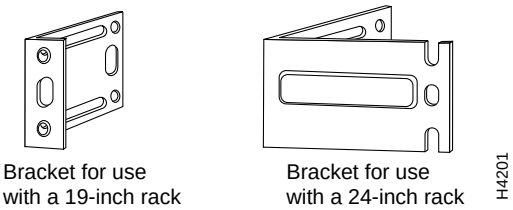
Step 4 Place the router right-side up on a flat, smooth, secure surface.

Caution Do not place anything on top of the router that weighs more than 10 pounds (4.5 kg). Excessive weight on top could damage the chassis.

Rack-Mounting the Chassis

This section describes the procedures for rack-mounting the chassis. The chassis comes with brackets for use with a 19-inch rack or, if specified in your order, optional larger brackets for use with a 24-inch rack. The brackets are shown in Figure 3-3.

Figure 3-3 Identifying the Brackets



Attaching the Brackets

To install the chassis in a rack, attach the brackets in one of the following ways:

- With the front panel forward (see Figure 3-4)
- With the rear panel forward (see Figure 3-5)
- In a center-mount telco rack (see Figure 3-6)

Note The illustrations that follow show how to connect the bracket to one side of the chassis. The second bracket connects to the opposite side of the chassis.

Figure 3-4 Bracket Installation—Front Panel Forward

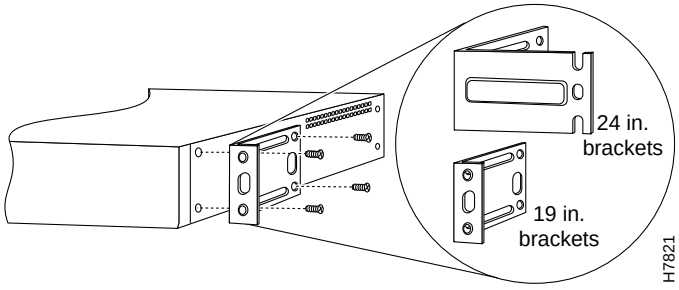


Figure 3-5 Bracket Installation—Rear Panel Forward

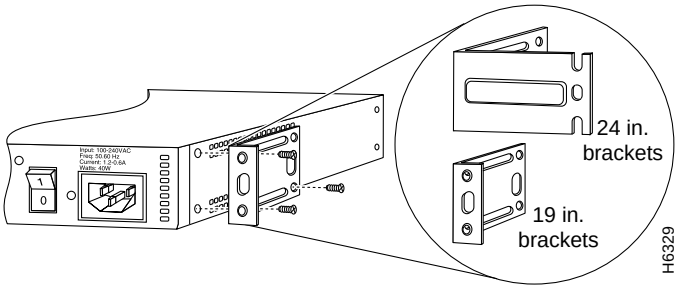
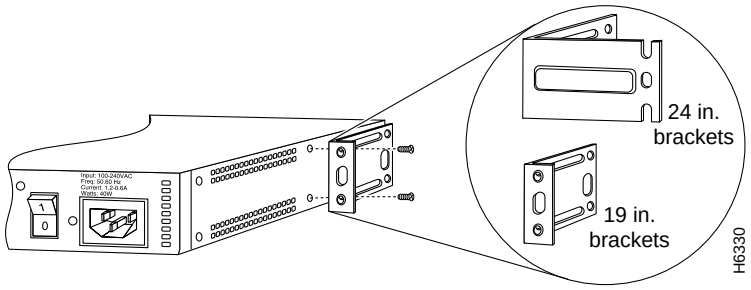


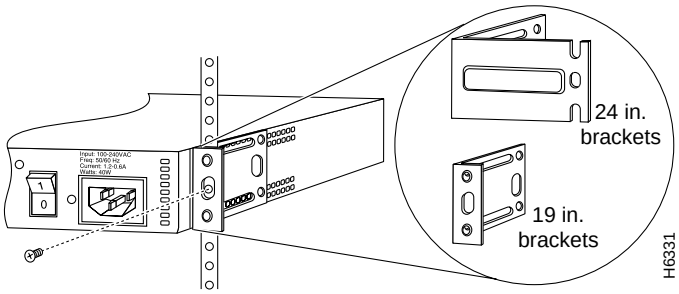
Figure 3-6 Telco Bracket Installation—Rear Panel Forward



Installing in a Rack

After the brackets are secured to the chassis, you can rack-mount it. Using the screws you provide, attach the chassis to the rack as shown in Figure 3-7.

Figure 3-7 Attaching the Chassis to a Rack (Rear Panel Forward Shown)



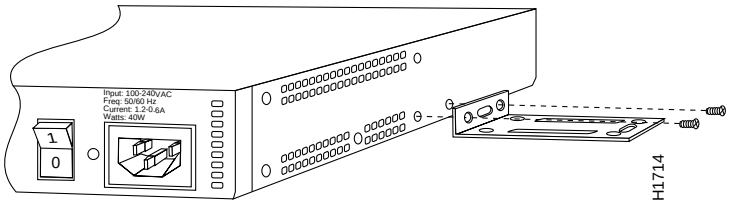
Wall-Mounting the Chassis

Use the small brackets (for use with a 19-inch rack) to wall-mount the chassis. The small brackets provide the most stable position for the chassis.

Take the following steps to wall-mount the chassis:

Step 1 Attach the brackets as shown in Figure 3-8.

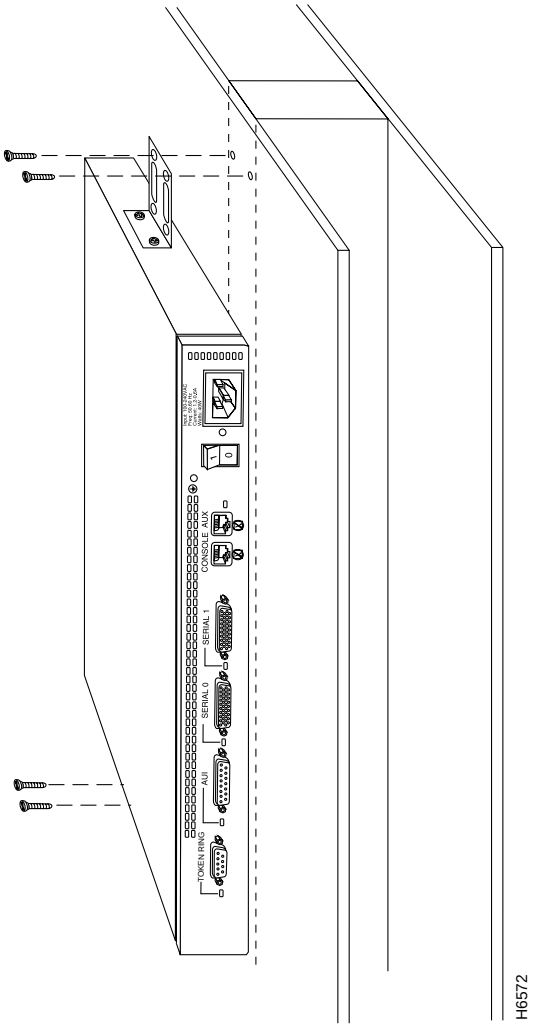
Figure 3-8 Attaching the Wall-Mount Brackets



Step 2 Attach the chassis assembly to the wall as shown in Figure 3-9, using screws and anchors that you provide. We recommend the following:

- For the best support of the chassis and cables, attach the brackets so that the screws align with a vertical wall stud. (See Figure 3-9.) This position will prevent the chassis from pulling away from the wall when cables are attached.
- For the best ventilation of the chassis, mount the chassis with the power supply and fan at the top. Make sure there is clearance between the router and the wall.

Figure 3-9 Wall-Mounting the Chassis



Connecting the DC Power Supply

Some router models offer an optional DC power supply. This section describes the DC power supply specifications and wiring.

Warning This unit is intended for installation in restricted access areas. A restricted access area is where access can only be gained by service personnel through the use of a special tool, lock and key, or other means of security, and is controlled by the authority responsible for the location. (To see translated versions of the warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

DC Power Specifications

The DC power supply is intended for use in DC operating environments. Table 3-1 lists the power supply specifications.

Table 3-1 DC Power Supply Specifications

Description	Design Specification
Power (input)	40W, –40 to –72 VDC
Wire gauge for power connections	14 AWG[1]

1. AWG = American Wire Gauge.

Wiring the DC Power Supply

If you ordered a router with a DC power supply, follow the directions in this section to wire the terminal block.

Warning Before performing any of the following procedures, ensure that power is removed from the DC circuit. To ensure that all power is OFF, locate the circuit breaker on the panel board that services the DC circuit, switch the circuit breaker to the OFF position, and tape the switch handle of the circuit breaker in the OFF position. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Note This product is intended for installation in restricted access areas and is approved for use with 14 AWG copper conductors only. The installation must comply with all applicable codes.

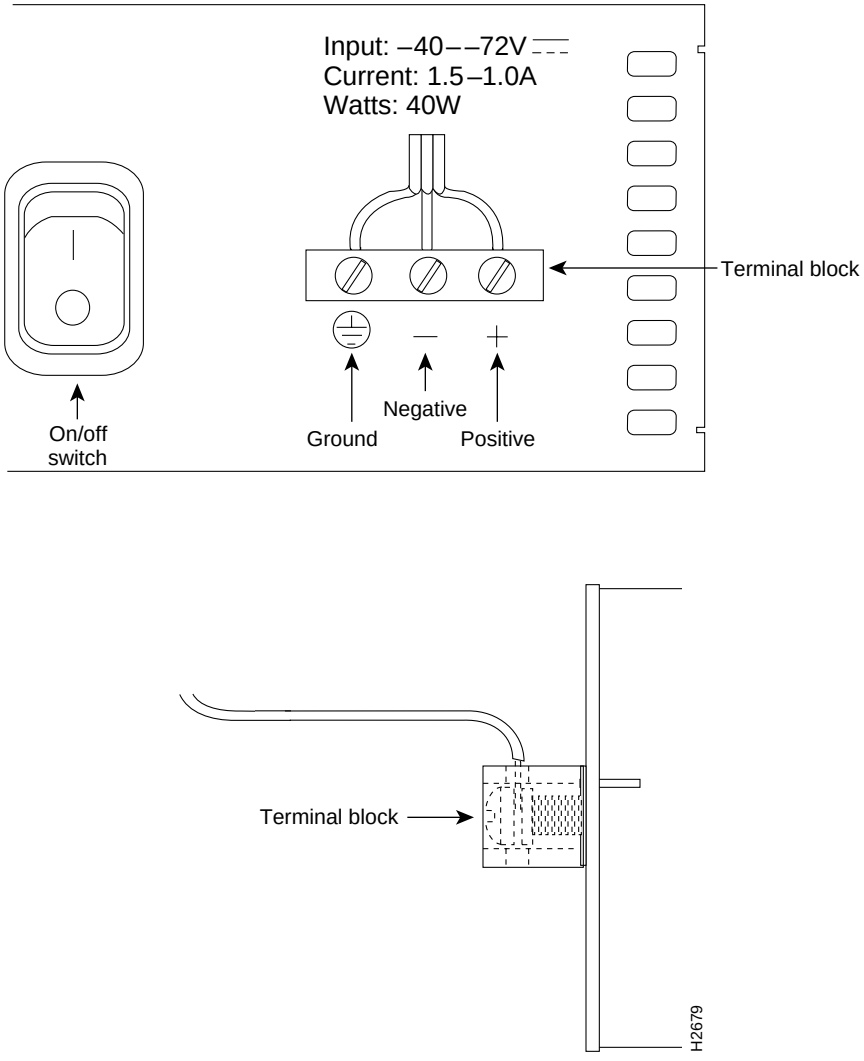
Take the following steps to wire the terminal block:

Step 1 Attach the appropriate lugs at the wire end of the power supply cord.

Step 2 Wire the DC power supply to the terminal block, as shown in Figure 3-10.

Warning The illustration shows the DC power supply terminal block. Wire the DC power supply using the appropriate lugs at the wiring end, as illustrated. The proper wiring sequence is ground to ground, positive to positive (line to L), and negative to negative (neutral to N). Note that the ground wire should always be connected first and disconnected last. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Figure 3-10 DC Power Supply Connections



Warning When stranded wiring is required, use approved wiring terminations, such as closed-loop or spade-type with upturned lugs. These terminations should be the appropriate size for the wires and should clamp both the insulation and conductor. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Caution Do not overtorque the terminal block captive thumbscrew or terminal block contact screws. The recommended torque is 8.2 0.4 inch-lb

Warning After wiring the DC power supply, remove the tape from the circuit breaker switch handle and reinstate power by moving the handle of the circuit breaker to the ON position. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Connecting to a Network

This section explains how to connect the router to your network. The Ethernet or Token Ring ports are used to connect the router to a LAN. The synchronous serial and ISDN ports are used to connect the router to a WAN.

The cables required to connect the router to a network are not provided with the router. For ordering information, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter. For cable pinouts, refer to the appendix “Cable Specifications.”

Although the illustrations in this section show the model 2513 router, the procedures are the same for all of the router models.

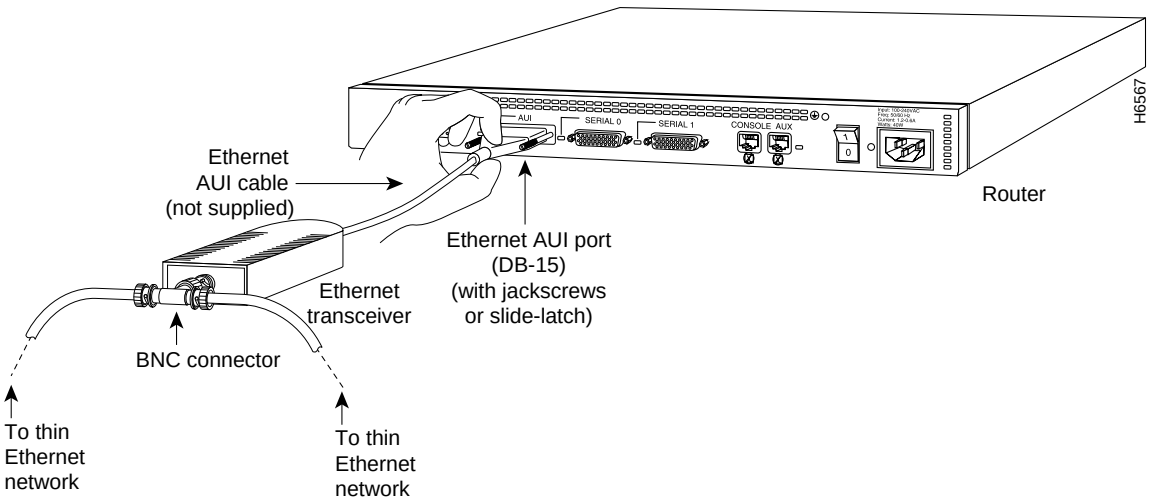
Warning Do not work on the system or connect or disconnect cables during periods of lightning activity. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Take the following steps to connect your router to a network:

Step 1 Connect the Ethernet AUI port (DB-15) to an Ethernet transceiver, as shown in Figure 3-11. Or connect a transceiver directly to the Ethernet AUI port.

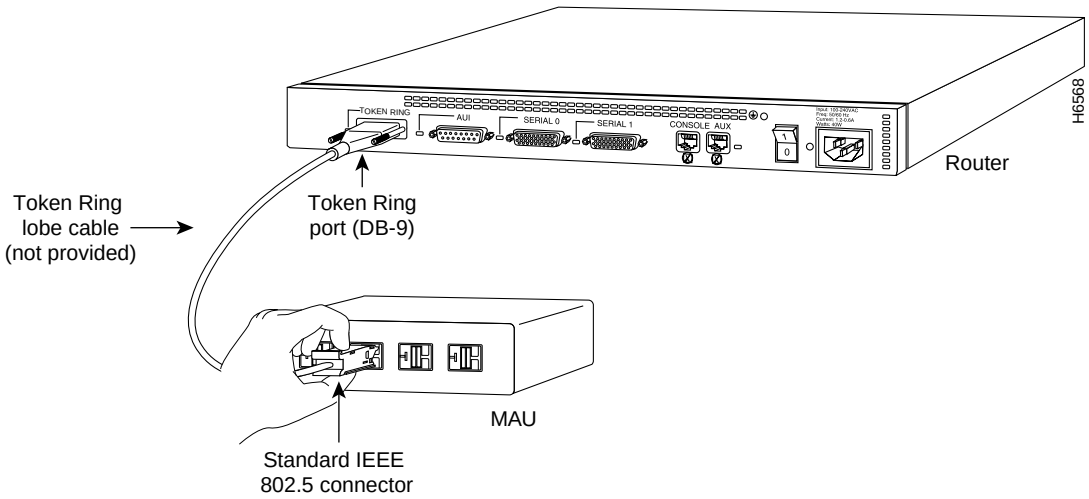
Note If your Ethernet connection requires jackscrews, remove the slide-latch assembly from the AUI connector and attach the jackscrews provided.

Figure 3-11 Connecting an Ethernet Transceiver



Step 2 Connect the Token Ring port (DB-9) to a MAU, as shown in Figure 3-12. To ensure agency compliance with electromagnetic emissions requirements (EMI), ensure that the lobe cable is shielded.

Figure 3-12 Connecting a MAU

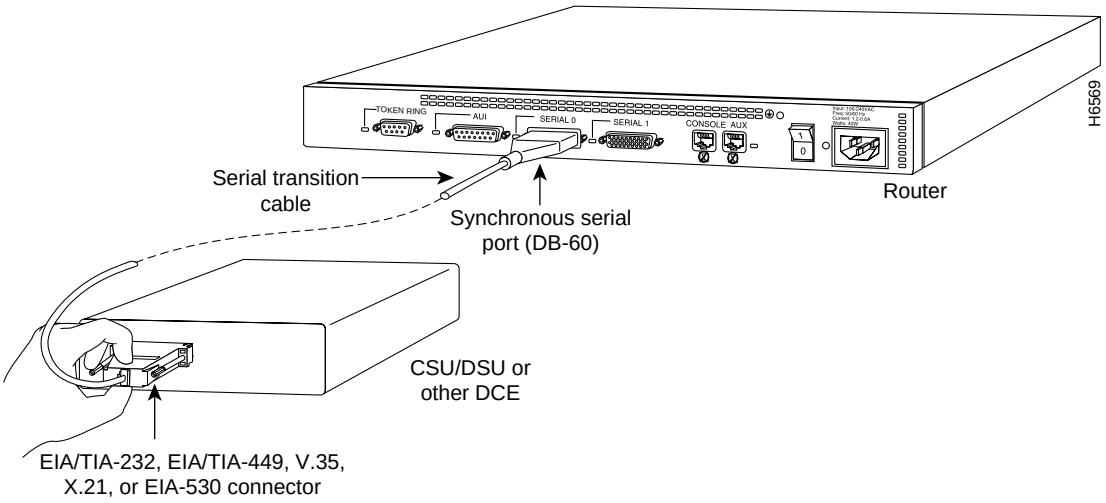


Step 3 If you will be using AutoInstall to configure the router, connect the synchronous serial port (DB-60) to a CSU/DSU or other DCE device, as shown in Figure 3-13. If you do not plan to use AutoInstall (or you are not sure what AutoInstall is) do not connect the WAN cable until after you have configured the router.

If a WAN cable is connected when you power ON the router for the first time, it will attempt to run AutoInstall to download a configuration file from a TFTP server. It can take several minutes for the router to determine that the necessary files are not in place for AutoInstall to begin. For more information about AutoInstall, refer to the Cisco IOS configuration guide, which is available on the documentation CD that accompanied your router.

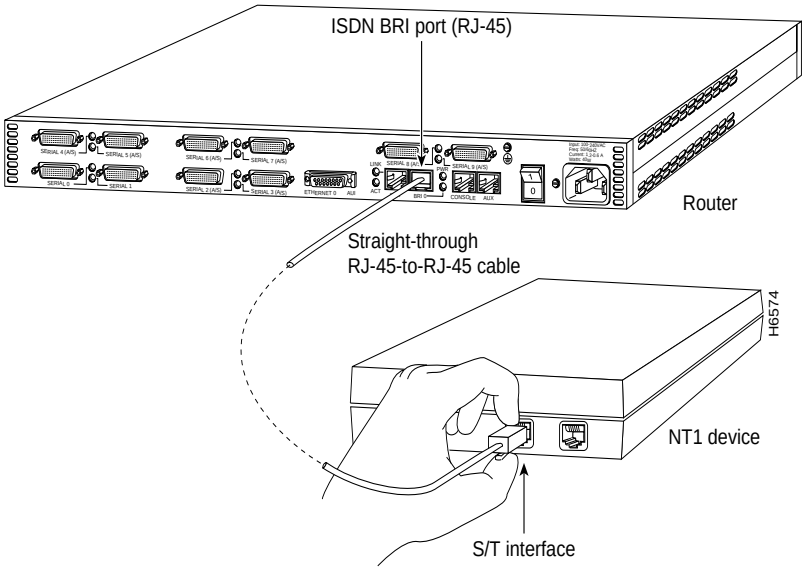
Note The synchronous serial port supports the following signaling standards: EIA/TIA-232, EIA/TIA-449, V.35, X.21, and EIA-530.

Figure 3-13 Connecting a CSU/DSU or Other DCE Device



Step 4 Connect the ISDN BRI port (RJ-45) to an NT1 device. (See Figure 3-14.)

Figure 3-14 Connecting an NT1 Device



Step 5 Connect the power cable to the router and the power source.

Connecting the Console Terminal and Modem

Your router includes asynchronous serial console and auxiliary ports. These ports provide administrative access to your router either locally (with a console terminal) or remotely (with a modem).

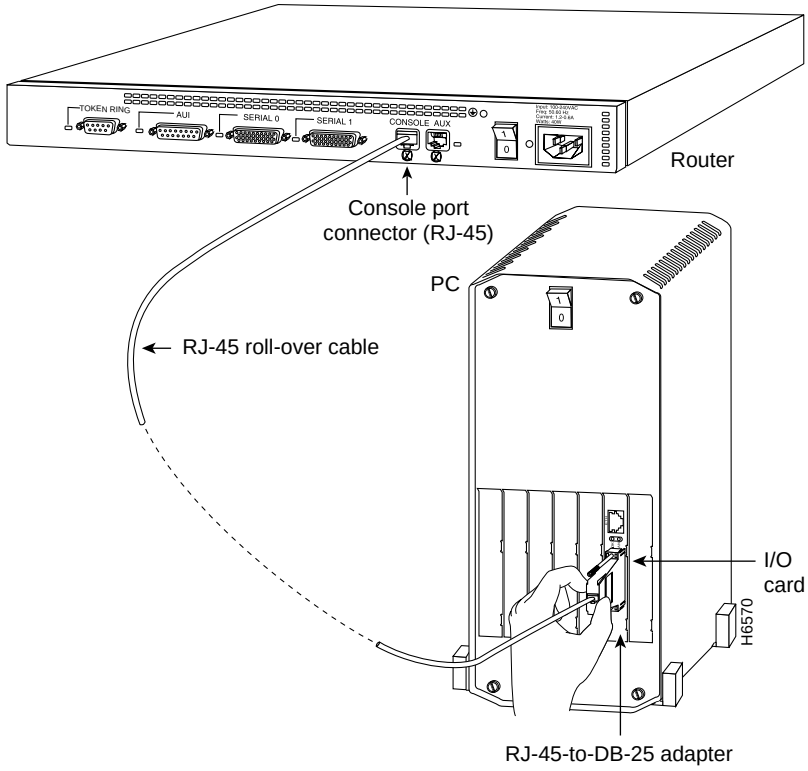
Connecting to the Console Port

Take the following steps to connect a terminal (an ASCII terminal or a PC running terminal emulation software) to the console port on the router:

Step 1 Connect the terminal using the thin, flat, RJ-45-to-RJ-45 roll-over cable (looks like a telephone cable) and an RJ-45-to-DB-9 or RJ-45-to-DB-25 adapter (labeled “TERMINAL”) included with the router. (See Figure 3-15.)

Step 2 Configure your terminal or PC terminal emulation software for 9600 baud, 8 data bits, no parity, and 2 stop bits.

Figure 3-15 Connecting a Console Terminal



Connecting a Modem to the Auxiliary Port

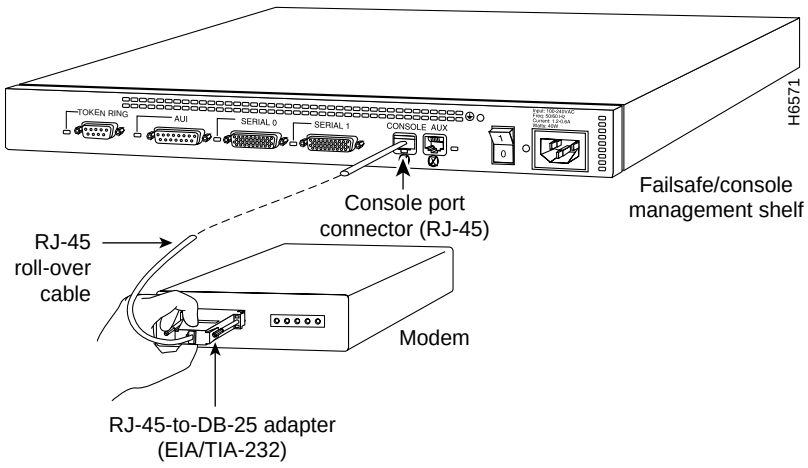
Take the following steps to connect a modem to the auxiliary port on the router:

Step 1 Connect a modem to the auxiliary port using the thin, flat, RJ-45-to-RJ-45 roll-over cable (looks like a telephone cable) with the RJ-45-to-DB-25 adapter (labeled “MODEM”) included with the router. (See Figure 3-16.)

Step 2 Make sure that your modem and the auxiliary port on the router are configured for the same transmission speed (38400 baud is typical) and hardware flow control with Data Carrier Detect (DCD) and Data Terminal Ready (DTR) operations.

Warning This equipment is intended to be grounded. Ensure that the host is connected to earth ground during normal use. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied the router.)

Figure 3-16 Connecting a Modem



What to Do after Installing the Router Hardware

After you have installed the router, connect the power cable to the rear panel of the router and the power source and then power it ON. (If the router does not power ON, proceed to the “Troubleshooting the Router” appendix.)

Proceed to the next chapter, “Configuring the Router,” for initial software configuration information.

Note The Cisco configuration guide and command reference publications provide additional software configuration information. These publications are available on the documentation CD that came with your router or you can order printed copies. Refer to the section “Ordering Documentation” in the chapter “Overview of the Router” for ordering information.

CHAPTER 4

Configuring the Router

This chapter describes how to configure the routers and contains the following sections:

- Booting the Router for the First Time
- Configuring the Router for the First Time
- Cisco IOS Software Basics
- Configuring ISDN
- Verifying Network Connectivity
- Getting More Information

This chapter provides minimum software configuration information; it is not meant as comprehensive router configuration instructions. Detailed software configuration information is available in the Cisco IOS configuration guide and command reference publications. These publications are available on the documentation CD that came with your router or you can order printed copies. Refer to the section “Ordering Documentation” in the chapter “Overview of the Router” for ordering information.

Booting the Router for the First Time

Each time you power on the router, it goes through the following boot sequence:

1. The router goes through power-on self-test diagnostics to verify basic operation of the CPU, memory, and interfaces.
2. The system bootstrap software (boot image) executes and searches for a valid Cisco IOS image (router operating system software). The source of the Cisco IOS image (Flash memory or a Trivial File Transfer Protocol [TFTP] server) is determined by the configuration register setting. The factory-default setting for the configuration register is 0x2102, which indicates that the router should attempt to load a Cisco IOS image from Flash memory.
3. If after five attempts a valid Cisco IOS image is not found in Flash memory, the router reverts to boot ROM mode (which is used to install or upgrade a Cisco IOS image).
4. If a valid Cisco IOS image is found, then the router searches for a valid configuration file.
5. If a valid configuration file is not found in NVRAM, the router runs the System Configuration Dialog so you can configure it manually. For normal router operation, there must be a valid Cisco IOS image in Flash memory and a configuration file in NVRAM.

The first time you boot your router, you will need to configure the router interfaces and then save the configuration to a file in NVRAM.

Configuring the Router for the First Time

You can configure the router using one of the following procedures, which are described in this section:

- System Configuration Dialog—Recommended if you are not familiar with Cisco IOS commands.
- Configuration mode—Recommended if you are familiar with Cisco IOS commands.
- AutoInstall—Recommended for automatic installation if another router running Cisco IOS software is installed on the network. This configuration method must be set up by someone with experience using Cisco IOS software.

Timesaver Acquire the correct network addresses from your system administrator or consult your network plan to determine the correct addresses before you begin to configure the router.

Proceed with the procedure that best fits the needs of your network configuration and Cisco IOS software experience level. If you will be using configuration mode or AutoInstall to configure the router, and you would like a quick review of the Cisco IOS software, refer to the section "Cisco IOS Software Basics" later in this chapter. Otherwise, proceed with the next section "Using the System Configuration Dialog."

Using the System Configuration Dialog

If you do not plan to use AutoInstall, make sure all the WAN cables are disconnected from the router. This will prevent the router from attempting to run the AutoInstall process. The router will attempt to run AutoInstall whenever you power it ON if there is a WAN connection on both ends and the router does not have a configuration file stored in NVRAM. It can take several minutes for the router to determine that AutoInstall is not connected to a remote TCP/IP host.

If your router does not have a configuration (setup) file and you are not using AutoInstall, the router will automatically start the setup command facility. An interactive dialog called the System Configuration Dialog appears on the console screen. This dialog helps you navigate through the configuration process by prompting you for the configuration information necessary for the router to operate.

Many prompts in the System Configuration Dialog include default answers, which are included in square brackets following the question. To accept a default answer, press **Return**; otherwise, enter your response.

This section gives an example configuration using the System Configuration Dialog. When you are configuring your router, respond as appropriate for your network.

At any time during the System Configuration Dialog, you can request help by typing a question mark (?) at a prompt.

Before proceeding with the System Configuration Dialog, obtain from your system administrator the node addresses and the number of bits in the subnet field (if applicable) of the router ports.

Take the following steps to configure the router using the System Configuration Dialog:

Step 1 Connect a console terminal to the console port on the rear panel of your router, and then power ON the router. (For more information, refer to the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router.")

Note The default parameters for the console port are 9600 baud, 8 data bits, no parity, and 2 stop bits.

After about 30 seconds, information similar to the following is displayed on the console screen:

Note The messages displayed vary, depending on the interfaces on the rear panel of the router and the Cisco IOS release and feature set you selected. The screen displays in this section are for reference only and may not exactly reflect the screen displays on your console.

```
System Bootstrap, Version X.X(XXXX) [XXXXX XX], RELEASE SOFTWARE
Copyright (c) 1986-199X by Cisco Systems
2500 processor with 4096 Kbytes of main memory

Notice: NVRAM invalid, possibly due to write erase.

F3: 5797928+162396+258800 at 0x3000060
```

```
                Restricted Rights Legend

Use, duplication, or disclosure by the Government is
subject to restrictions as set forth in subparagraph
(c) of the Commercial Computer Software - Restricted
Rights clause at FAR sec. 52.227-19 and subparagraph
(c) (1) (ii) of the Rights in Technical Data and Computer
Software clause at DFARS sec. 252.227-7013.

           Cisco Systems, Inc.
           170 West Tasman Drive
           San Jose, California 95134-1706


Cisco Internetwork Operating System Software
IOS (tm) X000 Software (XXX-X-X), Version XX.X(XXXX) [XXXXX XXX]
Copyright (c) 1986-199X by Cisco Systems, Inc.
Compiled Fri 20-Oct-9X 16:02 by XXXXX
Image text-base: 0x03030FC0, data-base: 0x00001000
Cisco 25XX (68030) processor (revision A) with 4092K/2048K bytes of
memory.
Processor board ID 00000000
Bridging software.
SuperLAT software copyright 1990 by Meridian Technology Corp).
X.25 software, Version X.X, NET2, BFE and GOSIP compliant.
TN3270 Emulation software (copyright 1994 by TGV Inc).
Basic Rate ISDN software, Version X.X.
X Ethernet/IEEE 802.3 interface.
2 Serial network interfaces.
1 ISDN Basic Rate interface.
32K bytes of non-volatile configuration memory.
8192K bytes of processor board System flash (Read ONLY)

Notice: NVRAM invalid, possibly due to write erase.
         --- System Configuration Dialog ---

At any point you may enter a question mark '?' for help.
Refer to the 'Getting Started' Guide for additional help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.
Would you like to enter the initial configuration dialog? [yes]:
```

Step 2 Press **Return** or enter **yes** to begin the configuration process.

Step 3 When the System Configuration Dialog asks whether you want to view the current interface summary, press **Return** or enter **yes**:

```
First, would you like to see the current interface summary? [yes]:

Any interface listed with OK? value "NO" does not have a valid
configuration

Interface     IP-Address     OK?   Method     Status    Protocol
Ethernet0     unassigned     NO    not set    up        down
BRI0          unassigned     NO    not set    up        up
Serial0       unassigned     NO    not set    down      down
Serial1       unassigned     NO    not set    down      down
```

Step 4 Configure the global parameters. A typical configuration follows:

```
Configuring global parameters:

  Enter host name [Router]:
```

Next, you are prompted to enter an enable secret password. There are two types of privileged-level passwords:

- Enable secret password (a very secure, encrypted password)
- Enable password (a less secure, nonencrypted password)

The enable password is used when the enable secret password does not exist.

For maximum security, be sure the passwords are different. If you enter the same password for both, the router will accept your entry, but will display a warning message indicating that you should enter a different password.

Step 5 Enter an enable secret password:

```
The enable secret is a one-way cryptographic secret used
instead of the enable password when it exists.

  Enter enable secret: pail

The enable password is used when there is no enable secret
and when using older software and some boot images.
```

Step 6 Enter the enable and virtual terminal passwords:

```
Enter enable password: shovel
Enter virtual terminal password: vterm1
```

Step 7 Press **Return** to accept Simple Network Management Protocol (SNMP) management, or enter **no** to refuse it:

```
Configure SNMP Network Management? [yes]: no
```

Step 8 In the following example, the router is configured for AppleTalk, Internet Protocol (IP), and Internetwork Packet Exchange (IPX). Configure the appropriate protocols for your router:

```
Configure Vines? [no]:
Configure LAT? [no]:
Configure AppleTalk? [no]: yes
  Multizone networks? [no]: yes
Configure DECnet? [no]:
Configure IP? [yes]:
  Configure IGRP routing? [yes]:
  Your IGRP autonomous system number [1]: 15
Configure CLNS? [no]:
Configure bridging? [no]:
Configure IPX? [no]: yes
Configure XNS? [no]:
Configure Apollo? [no]:
```

Step 9 If your router includes an ISDN BRI port, enter the ISDN BRI switch type. The switch type appropriate for the router depends on the ISDN service provider's equipment. Table 4-1 lists the ISDN switch types.

```
Enter ISDN BRI Switch Type [none]: basic-5ess
```

Table 4-1 ISDN Switch Types

Country	ISDN Switch Type	Description
Australia	basic-ts013	Australian TS013 switches
Europe	basic-1tr6	German 1TR6 ISDN switches
	basic-nwnet3	Norwegian NET3 ISDN switches (phase 1)
	basic-net3	NET3 ISDN switches (UK and others)
	basic-net5	NET5 switches (UK and Europe)
	vn2	French VN2 ISDN switches
	vn3	French VN3 ISDN switches
Japan	ntt	Japanese NTT ISDN switches
New Zealand	basic-nznet3	New Zealand NET3 switches
North America	basic-5ess	AT&T basic rate switches
	basic-dms100	NT DMS-100 basic rate switches
	basic-ni1	National ISDN-1 switches

Configuring the ISDN BRI Interface

This section describes how to configure the ISDN BRI interface. If your router does not include an ISDN BRI interface, proceed to the next section, "Configuring Ethernet or Token Ring Interfaces."

The ISDN BRI interface is configured to allow connection to ISDN WANs. Determine which protocols to support on the ISDN BRI interface and enter the appropriate responses. In the following example, the system is configured for IP, AppleTalk, and IPX:

```
Configuring interface BRI0:
Is this interface in use? [yes]
Configure IP on this interface? [yes]
IP address for this interface: 172.16.71.1
Number of bits in subnet field [0]: 8
Class B network is 172.16.0.0, 8 subnet bits; mask is
    255.255.255.0
```

```
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]: yes
  AppleTalk starting cable range [0]: 1
  AppleTalk ending cable range [1]: 2
  AppleTalk zone name [myzone]:
  AppleTalk additional zone name: otherzone
  AppleTalk additional zone name:
Configure IPX on this interface? [no]: yes
  IPX network number [1]: B000
```

After you have completed the entire initial router configuration using the System Configuration Dialog, proceed to the section "Configuring ISDN," later in this chapter, for additional ISDN configuration information.

Configuring Ethernet or Token Ring Interfaces

The Ethernet and Token Ring interfaces are configured to allow connection to a LAN. To configure the interface parameters, you need to know your Ethernet or Token Ring interface network addresses.

Take the following steps to configure an Ethernet or Token Ring interface to allow communication over a LAN:

Step 1 Press **Return** or enter **yes** to configure the LAN interface:

```
Configuring interface Ethernet0:
  Is this interface in use? [yes]:
```

Step 2 Determine which protocols you want to support on the LAN interface and enter the appropriate responses. In the following example, the system is configured for IP, AppleTalk, and IPX:

```
Configure IP on this interface? [yes]:
  IP address for this interface: 172.16.72.1
  Number of bits in subnet field [8]: 8
  Class B network is 172.16.0.0, 8 subnet bits; mask is
  255.255.255.0
```

```
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [no]: yes
  AppleTalk starting cable range [0]: 3
  AppleTalk ending cable range [1]: 3
  AppleTalk zone name [myzone]:
  AppleTalk additional zone name: otherzone
  AppleTalk additional zone name:
Configure IPX on this interface? [no]: yes
  IPX network number [1]: B001
```

Step 3 If there is more than one LAN interface on your router, repeat this procedure to configure the second LAN interface.

Configuring the Synchronous Serial Interfaces

The synchronous serial interfaces are configured to allow connection to WANs. After the Ethernet or Token Ring port on your router has been configured, take the following steps to configure the synchronous serial interfaces:

Step 1 Press **Return** or enter **yes** to configure serial port 0:

```
Configuring interface Serial0:
  Is this interface in use? [yes]:
```

Step 2 Determine which protocols you want on the synchronous serial interface and enter the appropriate responses. In the following example, the system is configured for IP, AppleTalk, and IPX:

```
Configure IP on this interface? [yes]:
Configure IP unnumbered on this interface? [no]:
  IP address for this interface: 172.16.73.1
  Number of bits in subnet field [8]:
  Class B network is 172.16.0.0, 8 subnet bits; mask is
  255.255.255.0
Configure AppleTalk on this interface? [no]: yes
  Extended AppleTalk network? [yes]:
  AppleTalk starting cable range [2]: 4
  AppleTalk ending cable range [3]: 4
  AppleTalk zone name [myzone]: ZZ Serial
  AppleTalk additional zone name:
Configure IPX on this interface? [no]: yes
  IPX network number [2]: B002
```

Step 3 Configure the second synchronous serial interface, for example, as follows:

```
Configuring interface Serial1:
  Is this interface in use? [yes]:
  Configure IP on this interface? [yes]:
  Configure IP unnumbered on this interface? [no]:
    IP address for this interface: 172.16.74.2
    Number of bits in subnet field [8]:
    Class B network is 172.16.0.0, 8 subnet bits; mask is
    255.255.255.0
  Configure AppleTalk on this interface? [no]: yes
    AppleTalk starting cable range [3]: 5
    AppleTalk ending cable range [4]: 5
    AppleTalk zone name [myzone]: ZZ Serial
    AppleTalk additional zone name:
  Configure IPX on this interface? [no]: yes
    IPX network number [3]: B003
```

Step 4 The configuration you entered is now displayed and you are asked if you want to use the displayed configuration. If you enter **no**, you will lose the configuration information you just entered and you can begin the configuration again. If you enter **yes**, the configuration will be entered and saved in the startup configuration:

```
Use this configuration? [yes/no]: yes
Building configuration...
Use the enabled mode 'configure' command to modify this
configuration.


Press RETURN to get started!
```

Proceed to the section “Cisco IOS Software Basics” for more information about the Cisco IOS software.

Using Configuration Mode

You can configure the router manually if you do not want to use AutoInstall or the prompt-driven System Configuration Dialog. Take the following steps to configure the router manually:

Step 1 Connect a console terminal following the instructions in the section "Connecting the Console Terminal and Modem" in the chapter "Installing the Router," and then power ON the router.

Step 2 When you are prompted to enter the initial dialog, enter **no** to go into the normal operating mode of the router:

```
Would you like to enter the initial dialog? [yes]: no
```

Step 3 After a few seconds you will see the user EXEC prompt (Router>). Enter the **enable** command to enter privileged EXEC mode. You can only make configuration changes in privileged EXEC mode:

```
Router> enable
```

The prompt changes to the privileged EXEC prompt:

```
Router#
```

Step 4 Enter the **configure terminal** command at the privileged EXEC prompt to enter configuration mode:

```
Router# configure terminal
```

You can now enter any changes you want to the configuration. You will probably want to perform the following tasks:

(a) Assign a host name for the router using the **hostname** command.

(b) Enter an enable secret password using the **enable password** command.

(c) Assign addresses to the interfaces using the *protocol* **address** command.

(d) Specify which protocols to support on the interfaces.

Refer to the Cisco IOS configuration guide and command reference publications for more information about the commands you can use to configure the router.

Step 5 When you are finished configuring the router, enter the **exit** command until you return to the privileged EXEC prompt (Router#).

Step 6 To save the configuration changes to NVRAM, enter the **copy running-config startup-config** command at the privileged EXEC prompt.

```
Router# copy running-config startup-config
********
```

The router will now boot with the configuration you entered.

Using AutoInstall

The AutoInstall process is designed to configure the router automatically after connection to your WAN. In order for AutoInstall to work properly, a Transmission Control Protocol/Internet Protocol (TCP/IP) host on your network must be preconfigured to provide the required configuration files. The TCP/IP host may exist anywhere on the network as long as the following two conditions are maintained:

1. The host must be on the remote side of the router's synchronous serial connection to the WAN.
2. User Datagram Protocol (UDP) broadcasts to and from the router and the TCP/IP host must be enabled.

This functionality is coordinated by your system administrator at the site where the TCP/IP host is located. You should not attempt to use AutoInstall unless the required files have been provided on the TCP/IP host. For more information, refer to the Cisco IOS configuration guide and command reference publications.

Take the following steps to prepare your router for the AutoInstall process:

Step 1 Attach the WAN cable to the router.

Step 2 Power ON the router.

The router will load the operating system image from Flash memory. If the remote end of the WAN connection is connected and properly configured, the AutoInstall process will begin.

Step 3 If AutoInstall completes successfully, enter the **copy running-config startup-config** command in privileged EXEC mode to write the configuration data to the router's NVRAM:

```
Router# copy running-config startup-config
```

Taking this step saves the configuration settings that the AutoInstall process created to the router's NVRAM. If you do not do this, the configuration will be lost the next time you reload the router.

Cisco IOS Software Basics

This section provides you with some basic information about the Cisco IOS software and includes the following sections:

- Cisco IOS Modes of Operation
- Getting Context-Sensitive Help
- Saving Configuration Changes

Cisco IOS Modes of Operation

The Cisco IOS software provides access to several different command modes. Each command mode provides a different group of related commands.

For security purposes, the Cisco IOS software provides two levels of access to commands: user and privileged. The unprivileged user mode is called user EXEC mode. The privileged mode is called privileged EXEC mode and requires a password. The commands available in user EXEC mode are a subset of the commands available in privileged EXEC mode.

Table 4-2 describes some of the most commonly used modes, how to enter the modes, and the resulting prompts. The prompt helps you identify which mode you are in and, therefore, which commands are available to you.

Table 4-2 Cisco IOS Operating Modes

Mode of Operation	Usage	How to Enter the Mode	Prompt
User EXEC	User EXEC commands allow you to connect to remote devices, change terminal settings on a temporary basis, perform basic tests, and list system information. The EXEC commands available at the user level are a subset of those available at the privileged level.	Log in.	Router>
Privileged EXEC	Privileged EXEC commands set operating parameters. The privileged command set includes those commands contained in user EXEC mode, and also the **configure** command through which you can access the remaining command modes. Privileged EXEC mode also includes high-level testing commands, such as **debug**.	From user EXEC mode, enter the **enable** EXEC command.	Router#
Global configuration	Global configuration commands apply to features that affect the system as a whole.	From global configuration mode, enter the **configure** privileged EXEC command.	Router(config)#

Table 4-2 Cisco IOS Operating Modes (Continued)

Mode of Operation	Usage	How to Enter the Mode	Prompt
Interface configuration	Interface configuration commands modify the operation of an interface such as an Ethernet, Token Ring, or serial port. Many features are enabled on a per-interface basis. Interface configuration commands always follow an interface global configuration command, which defines the interface type.	From global configuration mode, enter the **interface** *type number* command. For example, enter the **interface serial 0** command to configure the serial 0 interface.	Router(config-if)#
ROM monitor	ROM monitor commands are used to perform low-level diagnostics. You can also use the ROM monitor commands to recover from a system failure and stop the boot process in a specific operating environment.[1]	From privileged EXEC mode, enter the **reload** EXEC command. Press Break during the first 60 seconds while the system is booting.	>

1. You can modify the configuration register value using the **config-reg** configuration command. Refer to the Cisco IOS configuration guide for more information.

Almost every configuration command also has a no form. In general, use the no form to disable a feature or function. Use the command without the keyword **no** to reenable a disabled feature or to enable a feature that is disabled by default. For example, IP routing is enabled by default. To disable IP routing, enter the **no ip routing** command and enter **ip routing** to reenable it. The Cisco IOS software command reference publication provides the complete syntax for the configuration commands and describes what the no form of a command does.

Getting Context-Sensitive Help

In any command mode, you can get a list of available commands by entering a question mark (?).

```
Router> ?
```

To obtain a list of commands that begin with a particular character sequence, type in those characters followed immediately by the question mark (?). Do not include a space. This form of help is called word help, because it completes a word for you.

```
Router# co?
configure  connect  copy
```

To list keywords or arguments, enter a question mark in place of a keyword or argument. Include a space before the question mark. This form of help is called command syntax help because it reminds you which keywords or arguments are applicable based on the command, keywords, and arguments you have already entered.

```
Router# configure ?
  memory    Configure from NV memory
  network   Configure from a TFTP network host
  terminal  Configure from the terminal
  <cr>
```

You can also abbreviate commands and keywords by entering just enough characters to make the command unique from other commands. For example, you can abbreviate the **show** command to **sh**.

Saving Configuration Changes

Any time you make changes to the router configuration, you must save the changes to memory because if you do not they will be lost if there is a system reload or power outage. There are two types of configuration files: the running (current operating) configuration and the startup configuration. The running configuration is stored in RAM; the startup configuration is stored in NVRAM.

To display the current running configuration, enter the **show running-config** command. Enter the **copy running-config startup-config** command to save the current running configuration to the startup configuration file in NVRAM.

```
Router> enable
Router# copy running-config startup-config
```

To display the startup configuration, enter the **show startup-config** command. Enter the **copy startup-config running-config** command to write the startup configuration to the running configuration:

```
Router> enable
Router# copy startup-config running-config
```

To erase both configuration files (and start over), enter the **write erase** and **reload** commands:

```
Router> enable
Router# write erase
Router# reload
```

Caution This command sequence will erase the entire router configuration in RAM and NVRAM and reload the router.

Configuring ISDN

This section describes a typical ISDN configuration for one or two B channels. In the examples that follow, the BRI port is configured for IP routing, Challenge Handshake Authentication Protocol (CHAP), and Point-to-Point Protocol (PPP) encapsulation.

For your reference, an example configuration follows in the next section, “Example ISDN Configuration.” You may want to refer to it during this procedure.

Take the following steps to configure the router for a basic ISDN PPP connection on a single B channel or two B channels, substituting the correct addresses and host names as appropriate for your network:

Step 1 Enter privileged EXEC mode:

```
Router> enable
password: enablepassword
```

Step 2 Enter the **configure terminal** command to enter global configuration mode. Then enter the host name of the current router, the user name of the target router (the router to which packets will be sent), and the password that the routers will use for CHAP caller identification. The user name and password are case sensitive and must match the host name and password of the target router (even if it is not a Cisco router):

```
Router# configure terminal
Router (config)# hostname currentrouter
Router (config)# username targetrouter password abc
```

Step 3 Enter the **isdn switch-type** command to configure the ISDN switch type (such as basic-5ess, basic-dms100, or basic-ni1). Refer to Table 4-1, earlier in this chapter, for a list of ISDN switch types supported.

```
Router (config)# isdn switch-type switch-type
```

Step 4 Configure the IP address and subnet mask for the LAN interface:

```
Router (config)# interface type port_number
Router (config-if)# ip address ipaddress subnetmask
```

Step 5 Configure the IP address and subnet mask for the BRI interface:

```
Router (config-if)# interface bri port_number
Router (config-if)# ip address ipaddress subnetmask
```

Step 6 If you are using an ISDN switch type (such as Basic NI1 or DMS-100) that requires a service profile identifier (SPID), enter the SPID and optional local directory number (LDN). The SPID and LDN are assigned by the ISDN service provider.

The SPID is a number that identifies the service to which you have subscribed. A SPID is not required for AT&T 5ESS service configured for a point-to-point connection.

The LDN is an optional seven-digit phone number for the channel.

```
Router (config-if)# isdn spid1 SPID_no [LDN]
Router (config-if)# isdn spid2 SPID_no [LDN]
```

Step 7 Configure the router for PPP encapsulation and CHAP authentication:

```
Router (config-if)# encapsulation ppp
Router (config-if)# ppp authentication chap
```

Step 8 Enter the **load-threshold** or **ppp multilink** command to set up a second B channel.

For bandwidth on demand, enter the **load-threshold** command to set the ISDN load threshold. The load threshold determines the percentage of network load at which the second ISDN B channel is activated. The value ranges from 1 to 255 (100 percent). In the following example, the value of 128 means that when the first B channel reaches 50 percent of its bandwidth capacity (128 equals 50 percent of 255), the second B channel will activate to assist with the bandwidth load:

```
Router (config-if)# dialer load-threshold 128
```

Alternatively, you can use Multilink PPP to activate a second ISDN line. For Multilink PPP to work, the router must be running Cisco IOS Release 11.0(3) or a later release, and both the current router and target router must support Multilink PPP:

```
Router (config-if)# ppp multilink
```

Step 9 Enter the **dialer map** command to provide the information necessary to successfully route packets to the target router. Do not use periods or hyphens when entering the number to dial:

```
Router (config-if)# dialer map protocol targetBRIport_ipaddress
name targetrouter_number
```

Step 10 Enter the **dialer-group** command to specify the number of the group permitted to access the router:

```
Router (config-if)# dialer-group groupnumber
```

Step 11 Enter the **exit** command to exit interface configuration mode.

Step 12 Enter the **dialer list** command to specify the groups and protocols permitted to access the router:

```
Router (config)# dialer-list groupnumber protocol protocol_type
permit
```

Step 13 Configure a static route to allow connection to the target router's LAN. Enter the IP address and subnet mask of the target router's LAN interface, and the IP address of the target router's BRI port:

```
Router (config)# ip route targetrouter_ipnetwork subnetmask
targetBRIport_ipaddress
```

Step 14 Enter the **exit** command to exit global configuration mode.

Step 15 Enter the **copy running-config startup-config** command to save the configuration to NVRAM.

Example ISDN Configuration

For your reference, Table 4-3 shows an example configuration for two Cisco routers using IP over ISDN. In the example, the current router (branch1) is at a remote site and the target router (main1) is at a central site.

Table 4-3 Example ISDN Configuration

Configuration for the Current Router	Configuration for the Target Router
Router> **enable** password: **pail1** Router# **config term** Router (config)# **hostname branch1** branch1 (config)# **username main1 password secret1** branch1 (config)# **isdn switch-type basic-dms100** branch1 (config)# **interface Ethernet 0** branch1 (config)# **ip address 172.16.80.170 255.255.255.0** branch1 (config-if)# **interface bri 0** branch1 (config-if)# **ip address 172.16.71.1 255.255.255.0** branch1 (config-if)# **isdn spid1 415988488501 9884885** branch1 (config-if)# **isdn spid2 415988488602 9884886** branch1 (config-if)# **dialer load-threshold 128** branch1 (config-if)# **ppp multilink** branch1 (config-if)# **encapsulation ppp** branch1 (config-if)# **ppp authentication chap** branch1 (config-if)# **dialer map ip 172.16.71.2 name main1 9884883** branch1 (config-if)# **dialer group 1** branch1 (config-if)# **exit** branch1 (config)# **dialer-list 1 protocol ip permit** branch1 (config-if)# **ip route 172.16.0.0 255.255.0.0 172.16.71.2** branch1 (config-if)# **ip route 0.0.0.0 172.16.71.2** branch1 (config)# **exit** branch1# **copy running-config startup-config** branch1#	Router> **enable** password: **pail2** Router# **config term** Router (config)# **hostname main1** main1 (config)# **username branch1 password secret1** main1 (config)# **isdn switch-type basic-dms100** main1 (config)# **interface Ethernet 0** main1 (config)# **ip address 172.16.64.190 255.255.255.0** main1 (config-if)# **interface bri 0** main1 (config-if)# **ip address 172.16.71.2 255.255.255.0** main1 (config-if)# **isdn spid1 415988488201 9884882** main1 (config-if)# **isdn spid2 415988488302 9884883** main1 (config-if)# **dialer load-threshold 128** main1 (config-if)# **ppp multilink** main1 (config-if)# **encapsulation ppp** main1 (config-if)# **ppp authentication chap** main1 (config-if)# **dialer map ip 172.16.71.1 name branch1 9884885** main1 (config-if)# **dialer group 1** main1 (config-if)# **exit** main1 (config)# **dialer-list 1 protocol ip permit** main1 (config-if)# **ip route 172.16.80.0 255.255.0.0 172.16.71.1** main1 (config)# **exit** main1# **copy running-config startup-config** main1#

Verifying Network Connectivity

After you have installed and configured the router, you can use the following commands in user EXEC mode to verify network connectivity:

- **telnet**—Logs in to a remote node
- **ping**—Sends a special datagram to the destination device, then waits for a reply datagram from that device
- **trace**—Discovers the routes that packets take when traveling from one router to another

If there is a problem with network connectivity, refer to the section “Reading the LEDs” in the appendix “Troubleshooting the Router” and check the cable connections. If there is still a problem, check the router configuration.

Getting More Information

For more information about router software configuration, refer to the Cisco IOS configuration guide and command reference publications. These publications are available on the documentation CD that accompanied your router or you can order printed copies. Refer to the section “Ordering Documentation” in the “Overview of the Router” chapter for ordering information.

APPENDIX A

Troubleshooting the Router

This appendix contains information about how to isolate problems with the router and includes the following sections:

- Isolating Problems
- Reading the LEDs

Isolating Problems

The key to problem solving in this system is to try to isolate the problem to a specific subsystem. By comparing what the system is doing to what it should be doing, the task of isolating the problem is greatly simplified.

When problem solving, consider the following subsystems:

- Power and cooling systems—The power supply, power cable, and fan
- Ports and cables—The ports on the rear panel of the router and the cables that connect to them

Troubleshooting the Power and Cooling Systems

Check the following items to help isolate the problem:

- When the power switch is in the ON position (|) and the System OK LED is on, are the fans operating? If not, check the fans.
- Does the router shutdown after being ON a short time? Check the environmental conditions. The router might be overheating, resulting in a thermal-induced shutdown. Ensure that the chassis intake and exhaust vents are clear. Review the section "General Site Requirements" in the chapter "Preparing to Install the Router." The operating temperature for the router is 32 to 104° F (0 to 40°C).
- Does the router fail to boot, but the System OK LED is on? Check the power supply.
- Does the router constantly or intermittently reboot? There might be a problem with either the processor or the software, or a DRAM SIMM might be installed incorrectly.

For information about obtaining technical support, refer to the section "Obtaining Service and Support" in the "Overview of the Router" chapter.

Troubleshooting the Ports, Cables, and Connections

Check the following items to help isolate the problem:

- Does the router fail to recognize a port? Check the cable connection.
- When the power switch is in the ON position (|), is the System OK LED on? If not, check the power source and power cable.
- Does the system boot, but the console screen is frozen? Verify that the console is configured for 9600 baud, 8 data bits, no parity, and 2 stop bits.

For information about obtaining technical support, refer to the section "Obtaining Service and Support" in the "Overview of the Router" chapter.

Reading the LEDs

The LEDs indicate the current operating condition of the router. You can observe the LEDs, note any fault condition that the router is encountering, and then contact your system administrator or customer service, if necessary. For information about how to contact customer service, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter.

Figure A-1 to Figure A-7 show the location of the LEDs on the rear panel of the routers. The power LED, at the right of the auxiliary port, lights up when the system is working properly. All of the other LEDs indicate activity by flickering. When there is heavy activity on a port, the LED might be ON constantly. If an LED is not ON when the port is active and the cable is connected correctly, there might be a problem with the port.

Figure A-1 Model 2501 LEDs

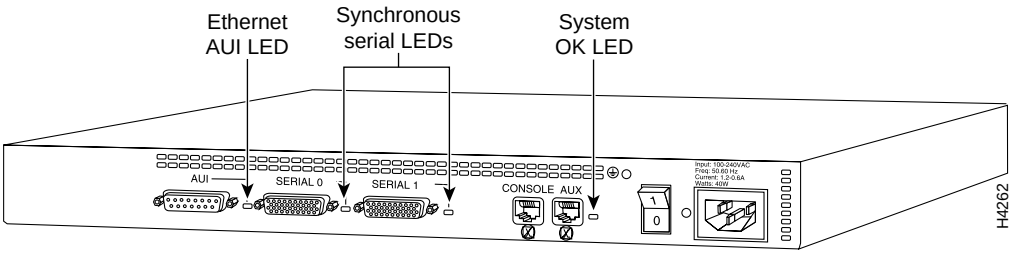


Figure A-2 Model 2502 LEDs

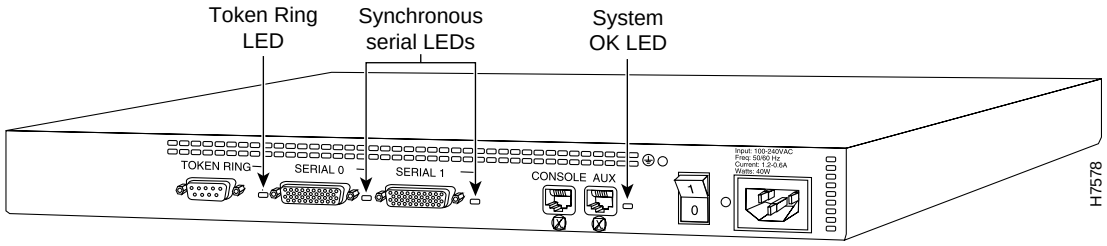


Figure A-3 Model 2503 LEDs

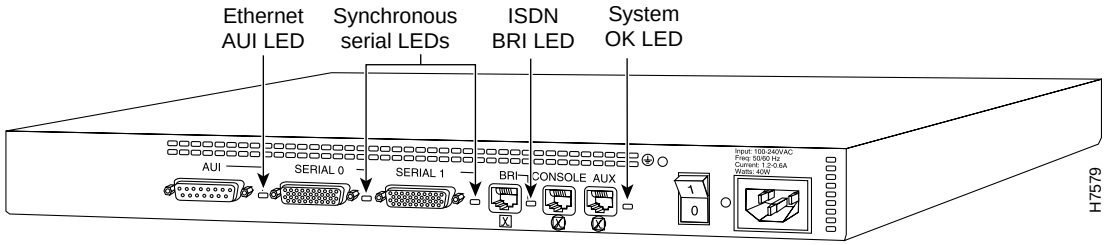


Figure A-4 Model 2504 LEDs

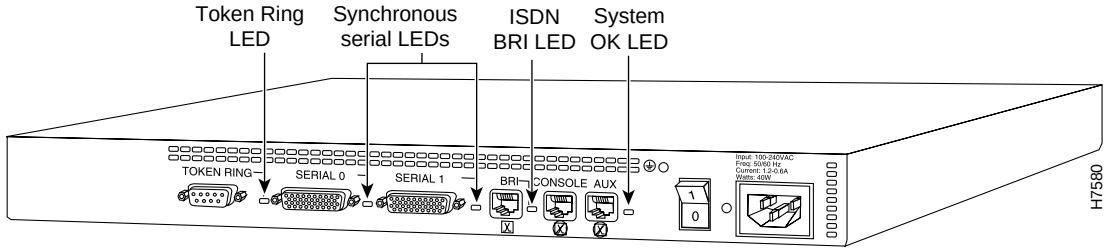


Figure A-5 Model 2513 LEDs

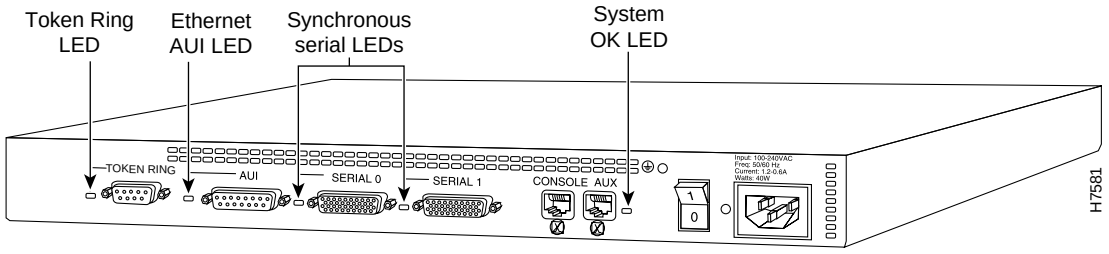


Figure A-6 Model 2514 LEDs

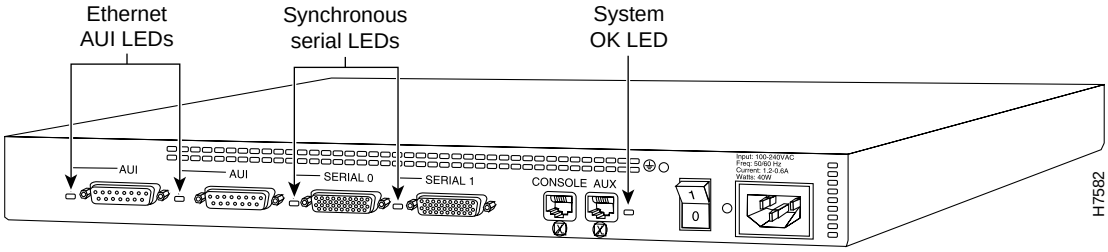
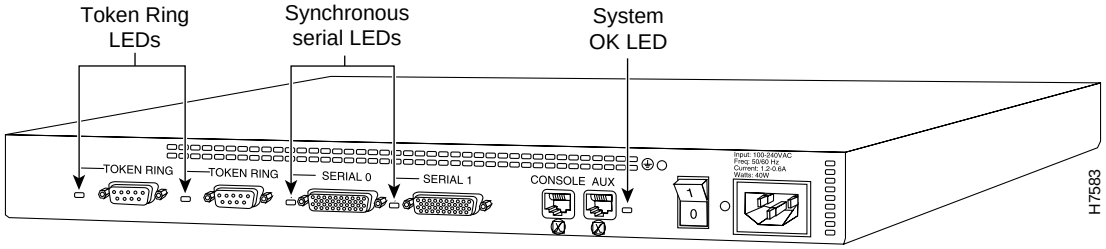


Figure A-7 Model 2515 LEDs



APPENDIX B

Maintaining the Router

This appendix contains selected maintenance procedures you might need to perform on the router as your internetworking needs change.

This appendix includes the following sections:

- Opening the Chassis
- Upgrading the DRAM SIMM
- Replacing the System-Code SIMMs
- Closing the Chassis

Additional maintenance procedures are available on the documentation CD that accompanied the router.

Caution Before opening the chassis, be sure that you have discharged all static electricity from your body and the power is OFF. Before performing any procedures described in this appendix, review the section "Safety Recommendations" in the chapter "Preparing to Install the Router."

Warning Before working on a chassis or working near power supplies, unplug the power cord on AC units; disconnect the power at the circuit breaker on DC units. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Opening the Chassis

This section describes the procedure for opening the chassis by removing the chassis cover.

Warning Do not touch the power supply when the power cord is connected. For systems with a power switch, line voltages are present within the power supply even when the power switch is OFF and the power cord is connected. For systems without a power switch, line voltages are present within the power supply when the power cord is connected. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Tools Required

You will need the following tools to open the chassis:

- Medium-size flat-blade screwdriver (1/4 inch [0.625 cm])
- Size M 3.5 (metric) hex-head nut driver (optional)

Removing the Chassis Cover

You must open the chassis to access the internal components. When opening the chassis, refer to Parts A and B in Figure B-1.

Warning Before opening the chassis, disconnect the telephone-network cables to avoid contact with telephone-network voltages. (To see translated versions of this warning, refer to the *Regulatory Compliance and Safety Information* document that accompanied your router.)

Take the following steps to remove the chassis cover:

Step 1 Power OFF the router.

Step 2 Disconnect all cables from the rear panel of the router.

Step 3 Turn the unit upside down so that the top of the chassis is resting on a flat surface, and the front of the chassis is facing toward you. (See Figure B-1, Part A.)

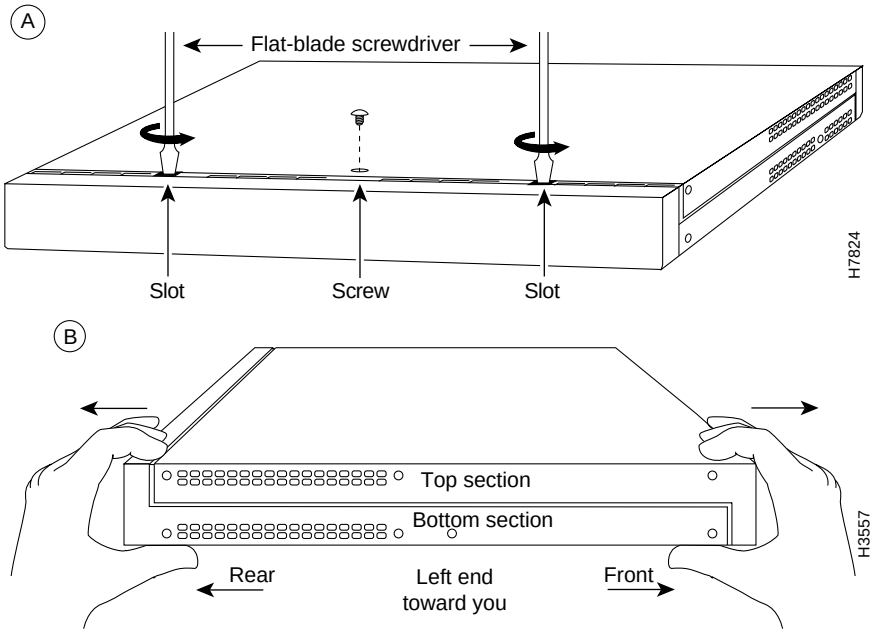
Step 4 Remove the single screw located on the bottom of the chassis (on the side closest to you). Note that the chassis is comprised of two sections: top and bottom.

Step 5 If required, insert a medium-size flat-blade screwdriver into the slots shown in Figure B-1, Part A, and gently rotate the blade so that the top and bottom sections separate slightly.

Step 6 Holding the chassis with both hands, position it as shown in Figure B-1, Part B.

Step 7 Pull the top section away from the bottom section. (See Figure B-1, Part B.) The fit is very snug, so it may be necessary to pry the chassis sections apart at one end and then the other until they separate.

Figure B-1 Chassis Cover Removal



Step 8 When the top cover is off, set it aside. Figure B-2 to Figure B-5 show the layout of the system cards for models 2501 to 2504 and 2513 to 2515, respectively.

Figure B-2 System Card Layout—Model 2501, 2502, 2503, and 2504 Routers

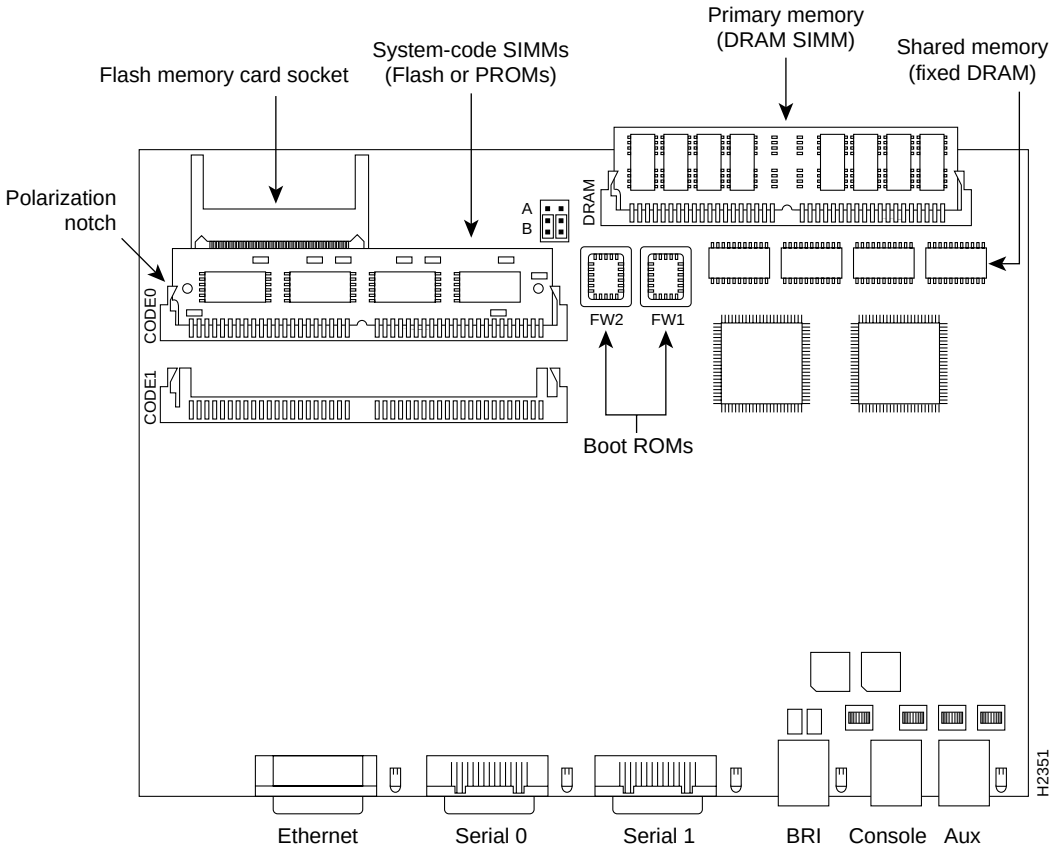
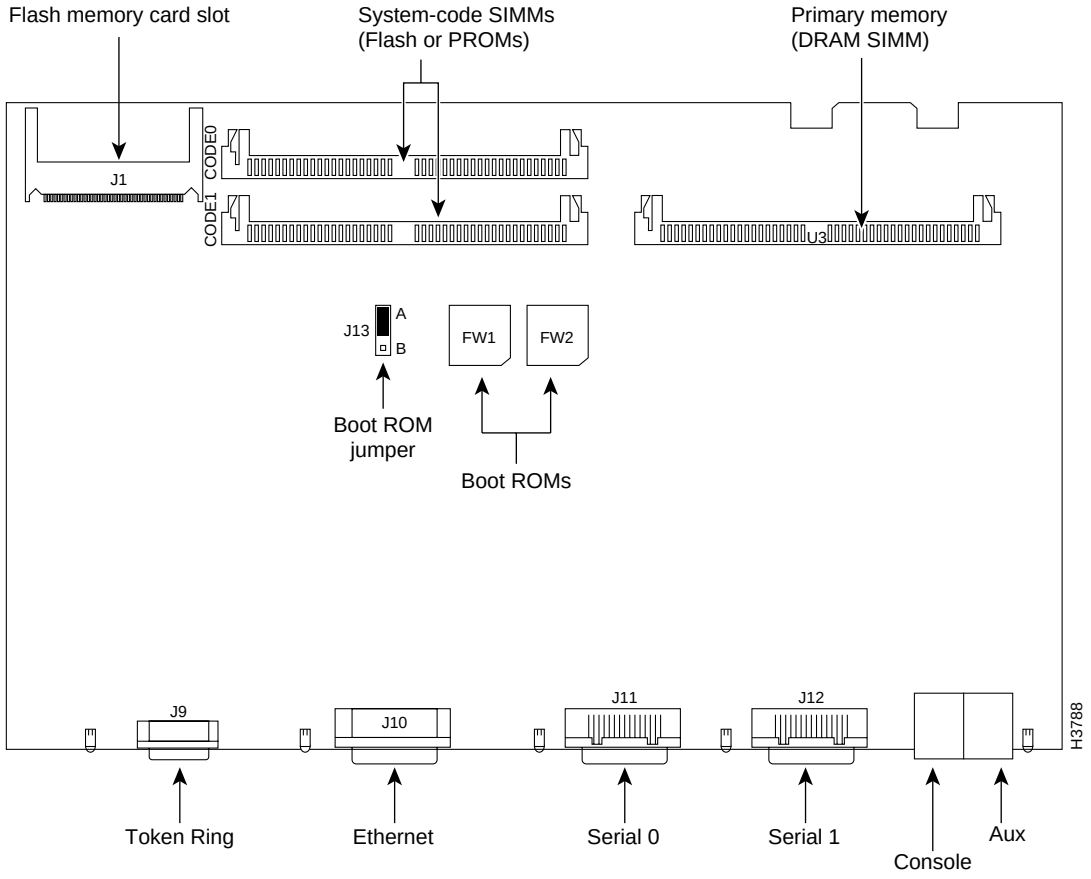
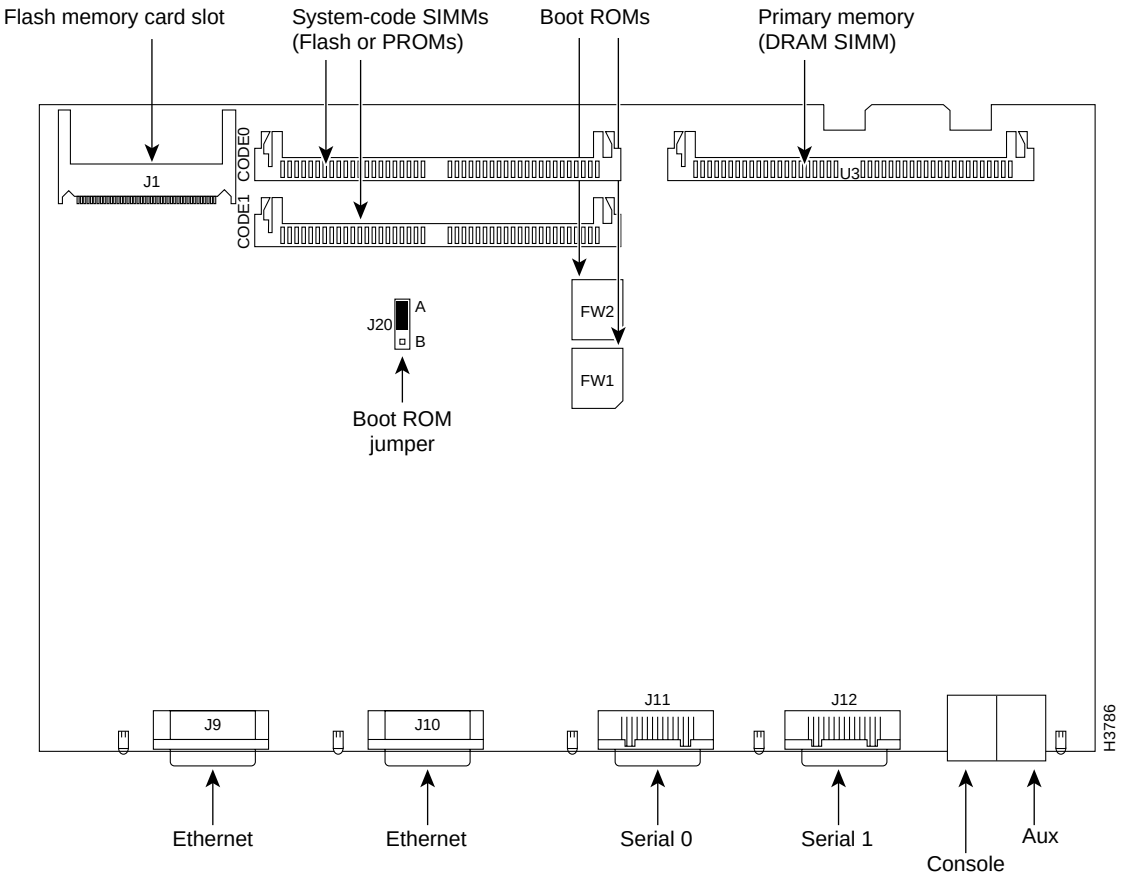


Figure B-3 System Card Layout—Model 2513 Router



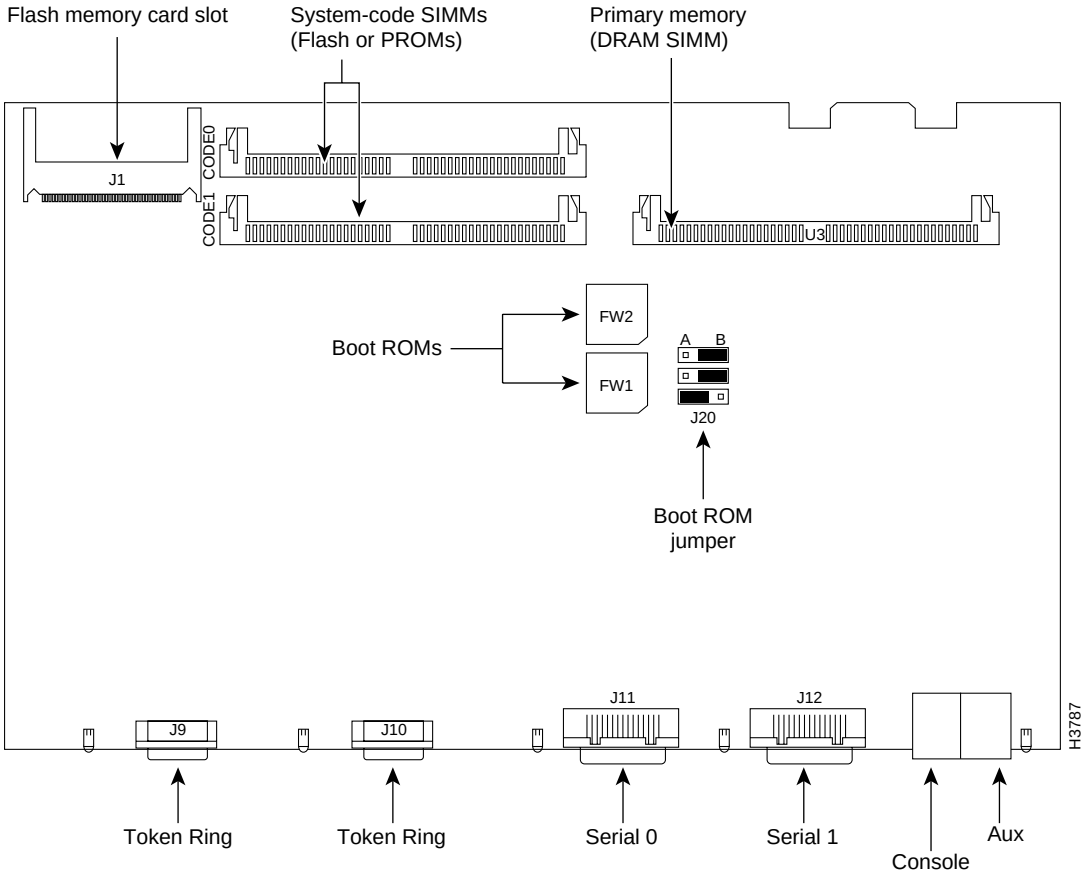
Note: SIMMs removed for clarity

Figure B-4 System Card Layout—Model 2514 Router



Note: SIMMs removed for clarity

Figure B-5 System Card Layout—Model 2515 Router



Note: SIMMs removed for clarity

Upgrading the DRAM SIMM

This section describes how to upgrade the DRAM SIMM on the system card. You might need to upgrade the DRAM SIMM for the following reasons:

- You upgrade the Cisco IOS feature set or release.
- Your router maintains large routing tables or other memory-intensive features, such as spoofing or protocol translations.

To see how much memory is currently installed in the router, enter the **show version** command. Near the middle of the resulting output, a message similar to the following displays:

```
Cisco XXXX(68030) processor (revision X) with 4092K/2048K bytes of memory.
```

This line shows how much memory is installed (in this example, 4092K/2048K). The first number represents primary memory and the second number represents shared memory.

Tools Required

You will need the following tools to remove and replace the DRAM SIMM on the router:

- Medium-size flat-blade screwdriver (1/4 inch [0.625 cm])
- ESD-preventive wrist strap
- The DRAM SIMM required for your planned upgrade

DRAM SIMM Installation

Take the following steps to install the DRAM SIMMs:

Step 1 Power OFF the router.

Step 2 Attach an ESD-preventive wrist strap.

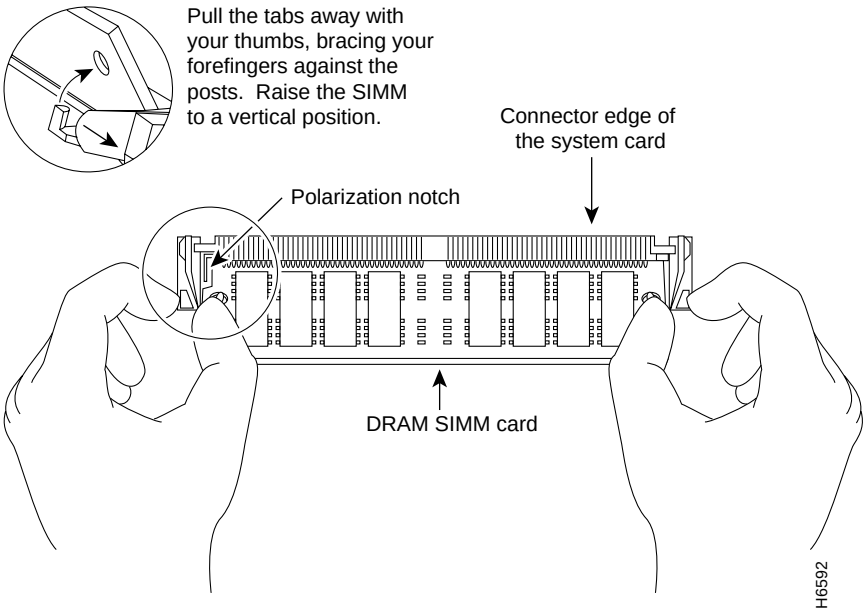
Step 3 Open the cover following the instructions in the section “Opening the Chassis” earlier in this appendix.

Step 4 Remove the existing DRAM SIMM by pulling outward on the connectors to unlatch them, as shown in Figure B-6. Be careful not to break the holders on the SIMM connector.

Caution To prevent damage, do not press on the center of the SIMMs. Handle each SIMM carefully.

Step 5 Position the new SIMM so that the polarization notch is located at the left end of the SIMM socket. (See Figure B-6.)

Figure B-6 Removing and Replacing the DRAM SIMM


Pull the tabs away with your thumbs, bracing your forefingers against the posts. Raise the SIMM to a vertical position.
Connector edge of the system card
Polarization notch
DRAM SIMM card
H6592

Step 6 Insert the new DRAM SIMM by sliding the end with the metal fingers into the SIMM connector socket at approximately a 45-degree angle to the system card. Gently rock the SIMM back into place until the latch on either side snaps into place. Do not use excessive force because the connector may break.

Step 7 Replace the router cover. Follow the instructions in the section "Closing the Chassis" later in this appendix.

Replacing the System-Code SIMMs

The system code (router operating system software) is stored in Flash memory SIMMs.

Tools Required

You will need the following tools to remove and replace the system-code SIMMs on the router:

- Medium-size flat-blade screwdriver (1/4 inch [0.625 cm])
- ESD-preventive wrist strap
- System-code SIMM(s)

Preparing to Install the System-Code SIMM

There are two system-code (Flash memory) SIMM sockets on the system board. If you want to install system-code SIMMs in both sockets, the SIMMs must be the same size. For example, if a 4-MB system-code SIMM is already installed in your router, the new SIMM must also be 4 MB. This upgrade would give you a total of 8 MB. You can verify how much Flash memory is already installed in your router by entering the **show flash** EXEC command.

Caution The system code is stored on the Flash memory SIMMs, but new system-code SIMMs are shipped without preinstalled software. Before proceeding with this procedure, use the **copy flash tftp** EXEC command to back up the system code to a TFTP server.

Note For more information about the **copy flash tftp** command and other related commands, refer to the Cisco IOS configuration and command reference publications. These publications are available on the documentation CD that came with your router or you can order printed copies. Refer to the section "Ordering Documentation" in the chapter "Overview of the Router" for ordering information.

System-Code SIMM Replacement

Take the following steps to upgrade the system-code Flash memory SIMMs:

Step 1 If you have not already done so, enter the **copy flash tftp** EXEC command to back up the system code.

Step 2 Power OFF the router.

Step 3 Remove all cables from the rear panel of the router.

Step 4 Attach an ESD-preventive wrist or ankle strap.

Step 5 Open the chassis cover following the procedure in the section "Opening the Chassis" earlier in this appendix.

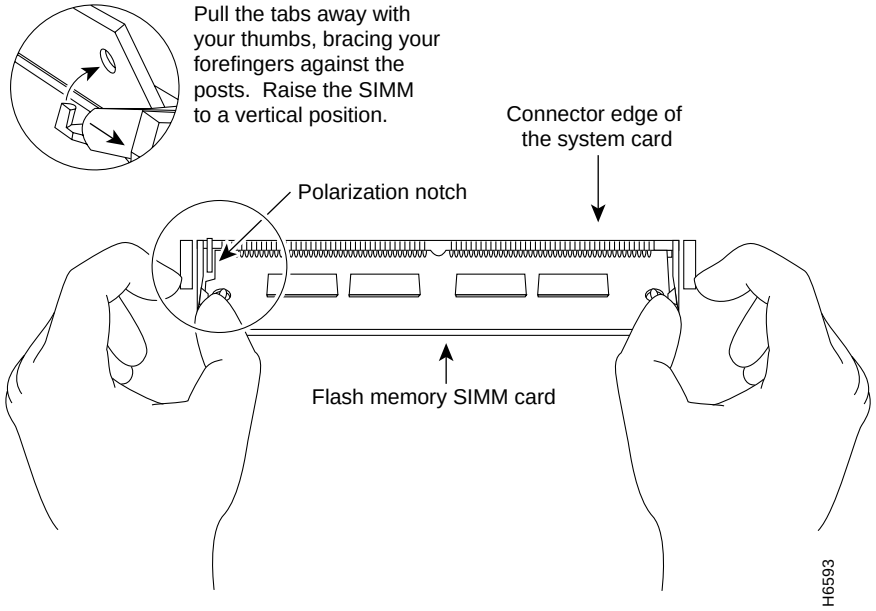
Step 6 Locate the system-code SIMMs on the system card, labeled CODE0 and CODE1. (See Figure B-2 to Figure B-5.)

Step 7 If necessary, remove the existing system-code SIMM by pulling outward on the connector holders to unlatch them. The connector holds the SIMM tightly, so be careful not to break the holders on the SIMM connector. (See Figure B-7.)

If you are installing system-code SIMMs in both sockets (CODE0 and CODE1), both SIMMs must be the same size. For example, if a 4-MB system-code SIMM is already installed in your router, the new SIMM must also be 4 MB. Populate the SIMM socket labeled CODE0 first; then populate CODE1.

Caution To prevent damage, do not press on the center of the SIMMs. Handle each SIMM carefully.

Figure B-7 Removing and Replacing the System-Code SIMM


Pull the tabs away with your thumbs, bracing your forefingers against the posts. Raise the SIMM to a vertical position.
Connector edge of the system card
Polarization notch
Flash memory SIMM card
H6593

Step 8 Position the new SIMM so that the polarization notch is located at the left end of the SIMM socket.

Caution To prevent damage, note that some Flash memory SIMMs have the components mounted on the rear side; therefore, when inserting the SIMM, always use the polarization notch as a reference and *not* the position of the components on the SIMM.

Step 9 Insert the new SIMM by sliding the end with the metal fingers into the appropriate SIMM connector socket (labeled CODE0 or CODE1) at approximately a 45-degree angle to the system card. Gently rock the SIMM back into place until the latches on both sides snap into place. Do not use excessive force because the connector may break.

Step 10 Replace the router cover following the procedure in the next section, "Closing the Chassis."

Closing the Chassis

This section describes the procedure for closing the chassis by replacing the cover.

Tools Required

You will need the following tools to replace the cover:

- Medium-size flat-blade screwdriver (1/4 inch [0.625 cm])
- Size M 3.5 hex-head nut driver (optional)

Replacing the Cover

Take the following steps to replace the cover:

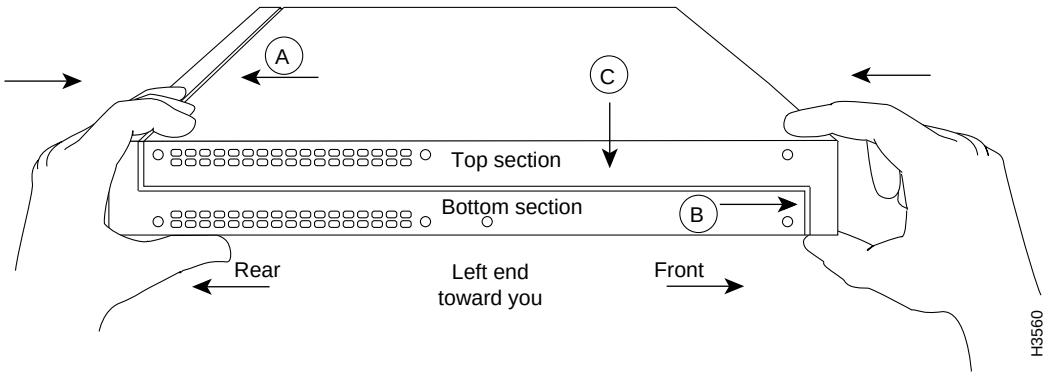
Step 1 Position the two chassis sections, as shown in Figure B-8.

Step 2 Referring to Figure B-8, press the two chassis sections together and ensure the following:

- The top section fits *into* the rear of the bottom section. (See A in Figure B-8.)
- The bottom section fits *into* the front of the top section. (See B in Figure B-8.)
- Each side of the top and bottom sections fits together. (See C in Figure B-8.)

Caution To fit the two sections together, it may be necessary to work them together at one end and then the other, working back and forth; however, use care to prevent bending the chassis edges.

Figure B-8 Replacing the Chassis Cover



Step 3 When the two sections fit together snugly, turn the chassis so that the bottom is facing up, with the front panel toward you.

Step 4 Replace the cover screw. (See Figure B-1.) Tighten the screw to no more than 8 or 9 inch/pounds of torque.

Step 5 Reinstall the chassis on the wall, rack, desktop, or table.

Step 6 Replace all cables.

APPENDIX C

Cable Specifications

This appendix provides the following pinout information:

- Console and Auxiliary Port Signals and Pinouts
- Ethernet Cable Assembly and Pinouts
- Token Ring Port Pinouts
- Synchronous Serial Cable Assemblies and Pinouts
- ISDN BRI Port and Cable Pinouts

Note All pins not listed in the tables in this appendix are not connected.

If you prefer to order cables, refer to the section “Obtaining Service and Support” in the “Overview of the Router” chapter for information about how to contact service.

Console and Auxiliary Port Signals and Pinouts

Your router comes with a console and auxiliary cable kit, which contains the cable and adapters you need to connect a console terminal (an ASCII terminal or PC running terminal emulation software) or modem to your router. The console and auxiliary cable kit includes the following items:

- RJ-45-to-RJ-45 roll-over cable. (See the next section, “Identifying a Roll-Over Cable,” for more information.)
- RJ-45-to-DB-9 female DTE adapter (labeled “TERMINAL”).

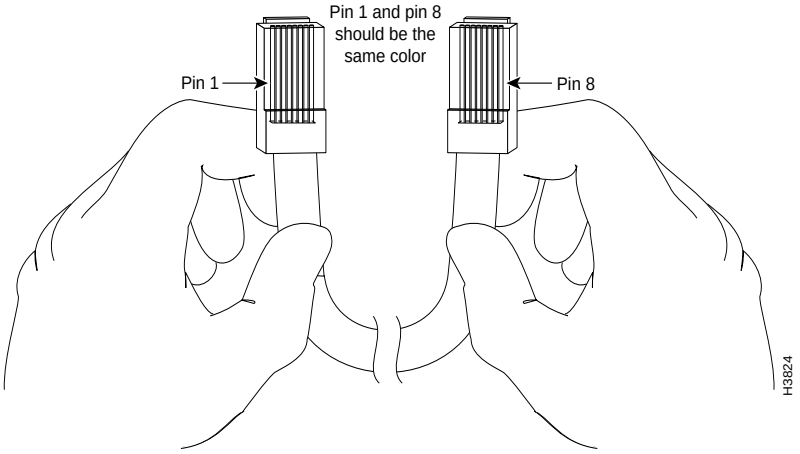
- RJ-45-to-DB-25 female DTE adapter (labeled “TERMINAL”).
- RJ-45-to-DB-25 male DCE adapter (labeled “MODEM”).

For console connections, proceed to the section “Console Port Signals and Pinouts” later in this appendix; for modem connections, proceed to the section “Auxiliary Port Signals and Pinouts” later in this appendix.

Identifying a Roll-Over Cable

You can identify a roll-over cable by comparing the two modular ends of the cable. Holding the cables side-by-side, with the tab at the back, the wire connected to the pin on the outside of the left plug should be the same color as the wire connected to the pin on the outside of the right plug. (See Figure C-1.) If your cable came from Cisco Systems, pin 1 will be white on one connector, and pin 8 will be white on the other (a roll-over cable reverses pins 1 and 8, 2 and 7, 3 and 6, and 4 and 5).

Figure C-1 Identifying a Roll-Over Cable



Console Port Signals and Pinouts

Use the thin, flat, RJ-45-to-RJ-45 roll-over cable and RJ-45-to-DB-9 female DTE adapter (labeled “TERMINAL”) to connect the console port to a PC running terminal emulation software. Figure C-2 shows how to connect the console port to a PC. Table C-1 lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 roll-over cable, and the RJ-45-to-DB-9 female DTE adapter (labeled “TERMINAL”).

Figure C-2 Connecting the Console Port to a PC

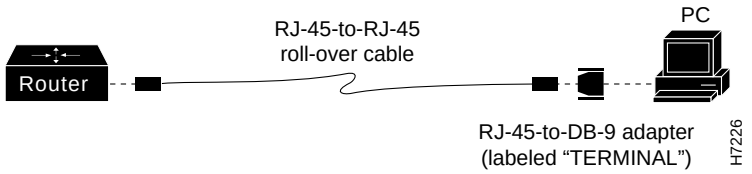


Table C-1 Console Port Signaling and Cabling Using a DB-9 Adapter

Console Port (DTE)	RJ-45-to-RJ-45 Roll-Over Cable		RJ-45-to-DB-9 Terminal Adapter	Console Device
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-9 Pin**	**Signal**
RTS	1[1]	8	8	CTS
DTR	2	7	6	DSR
TxD	3	6	2	RxD
GND	4	5	5	GND
GND	5	4	5	GND
RxD	6	3	3	TxD
DSR	7	2	4	DTR
CTS	8[1]	1	7	RTS

1. Pin 1 is connected internally to Pin 8.

Use the thin, flat, RJ-45-to-RJ-45 roll-over cable and RJ-45-to-DB-25 female DTE adapter (labeled “TERMINAL”) to connect the console port to a terminal. Figure C-3 shows how to connect the console port to a terminal. Table C-2 lists the pinouts for the asynchronous serial console port, the RJ-45-to-RJ-45 roll-over cable, and the RJ-45-to-DB-25 female DTE adapter (labeled “TERMINAL”).

Figure C-3 Connecting the Console Port to a Terminal

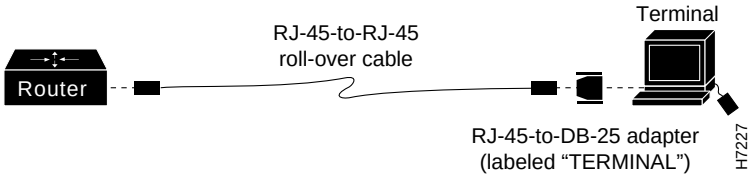


Table C-2 Console Port Signaling and Cabling Using a DB-25 Adapter

Console Port (DTE)[1]	RJ-45-to-RJ-45 Roll-Over Cable		RJ-45-to-DB-25 Terminal Adapter	Console Device
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-25 Pin**	**Signal**
RTS	1[2]	8	5	CTS
DTR	2	7	6	DSR
TxD	3	6	3	RxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	TxD
DSR	7	2	20	DTR
CTS	8[1]	1	4	RTS

1. You can use the same cabling to connect a console to the auxiliary port.
2. Pin 1 is connected internally to Pin 8.

Auxiliary Port Signals and Pinouts

Use the thin, flat, RJ-45-to-RJ-45 roll-over cable and RJ-45-to-DB-25 male DCE adapter (labeled “MODEM”) to connect the auxiliary port to a modem. Figure C-4 shows how to connect the auxiliary port to a modem. Table C-3 lists the pinouts for the asynchronous serial auxiliary port, the RJ-45-to-RJ-45 roll-over cable, and the RJ-45-to-DB-25 male DCE adapter (labeled “MODEM”).

Figure C-4 Connecting the Auxiliary Port to a Modem

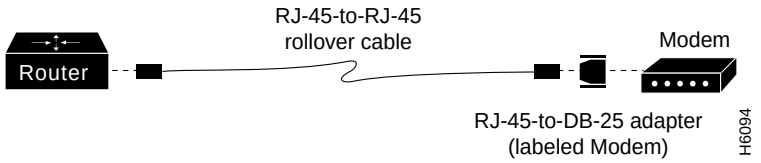


Table C-3 Auxiliary Port Signaling and Cabling Using a DB-25 Adapter

Auxiliary Port (DTE)	RJ-45-to-RJ-45 Roll-Over Cable		RJ-45-to-DB-25 Modem Adapter	Modem
Signal	**RJ-45 Pin**	**RJ-45 Pin**	**DB-25 Pin**	**Signal**
RTS	1[1]	8	4	RTS
DTR	2	7	20	DTR
TxD	3	6	3	TxD
GND	4	5	7	GND
GND	5	4	7	GND
RxD	6	3	2	RxD
DSR	7	2	8	DCD
CTS	8[1]	1	5	CTS

1. Pin 1 is connected internally to Pin 8.

Ethernet Cable Assembly and Pinouts

This section describes the pinouts for an Ethernet AUI cable.

Figure C-5 shows an Ethernet AUI cable assembly, and Table C-4 lists the cable pinouts.

Figure C-5 Ethernet AUI Cable Assembly

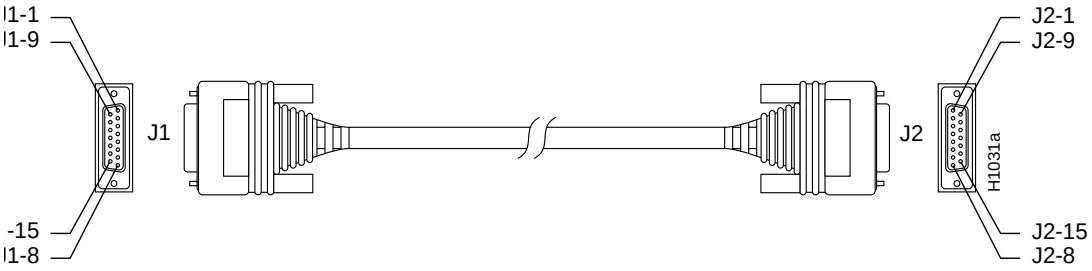


Table C-4 Ethernet AUI Cable Pinouts (DB-15)

Pin	Ethernet Circuit	Signal
3	DO-A	Data Out Circuit A
10	DO-B	Data Out Circuit B
11	DO-S	Data Out Circuit Shield
5	DI-A	Data In Circuit A
12	DI-B	Data In Circuit B
4	DI-S	Data In Circuit Shield
2	CI-A	Control In Circuit A
9	CI-B	Control In Circuit B
1	CI-S	Control In Circuit Shield
6	VC	Voltage Common
13	VP	Voltage Plus

Table C-4 Ethernet AUI Cable Pinouts (DB-15) (Continued)

Pin	Ethernet Circuit	Signal
14	VS	Voltage Shield (L25 and M25)
Shell	PG	Protective Ground

Token Ring Port Pinouts

Table C-5 lists the Token Ring port pinouts. Use a Token Ring lobe cable (not included) to connect the Token Ring port to a MAU.

Table C-5 Token Ring Port (DB-9) Pinouts

9 Pin[1]	Signal
1	Receive
3	+5V[2]
5	Transmit
6	Receive
9	Transmit

1. Pins 2, 4, 7, and 8 are ground.
2. 600 mA maximum.

Synchronous Serial Cable Assemblies and Pinouts

The illustrations and tables in this section provide assembly drawings and pinouts for the EIA-530 DCE, EIA/TIA-232, EIA/TIA-449, V.35, and X.21 DTE and DCE cables, which are used with the synchronous serial WAN port (labeled “SERIAL”).

EIA-530

Figure C-6 shows the EIA-530 serial cable assembly, and Table C-6 lists the pinouts. Arrows indicate signal direction: —> indicates DTE to DCE, and <— indicates DCE to DTE.

Figure C-6 EIA-530 Serial Cable Assembly

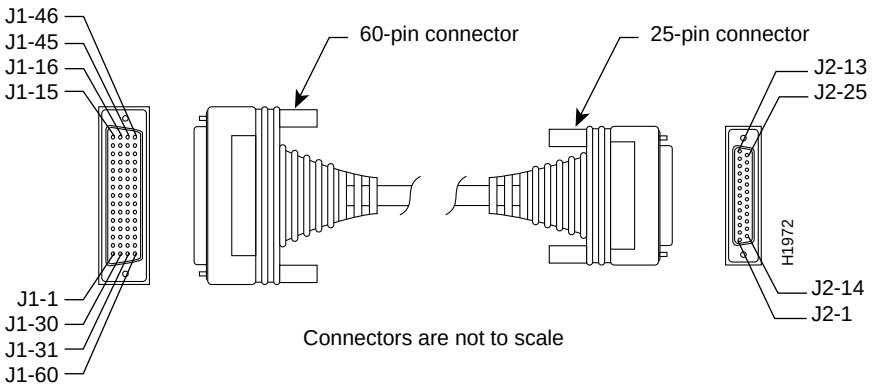


Table C-6 EIA-530 DTE Cable Pinouts (DB-60 to DB-25)

60 Pin	Signal	25 Pin	Signal	Direction DTE DCE[1]
J1-11	TxD/RxD+	J2-2	BA(A), TxD+	—>
J1-12	TxD/RxD–	J2-14	BA(B), TxD–	—>
J1-28	RxD/TxD+	J2-3	BB(A), RxD+	<—
J1-27	RxD/TxD–	J2-16	BB(B), RxD–	<—
J1-9	RTS/CTS+	J2-4	CA(A), RTS+	—>
J1-10	RTS/CTS–	J2-19	CA(B), RTS–	—>

Table C-6 EIA-530 DTE Cable Pinouts (DB-60 to DB-25) (Continued)

60 Pin	Signal	25 Pin	Signal	Direction DTE DCE[1]
J1-1	CTS/RTS+	J2-5	CB(A), CTS+	<—
J1-2	CTS/RTS–	J2-13	CB(B), CTS–	<—
J1-3	DSR/DTR+	J2-6	CC(A), DSR+	<—
J1-4	DSR/DTR–	J2-22	CC(B), DSR–	<—
J1-46	Shield_GND	J2-1	Shield	Shorted
J1-47	MODE_2	–	–	
J1-48	GND	–	–	Shorted
J1-49	MODE_1	–	–	
J1-5	DCD/DCD+	J2-8	CF(A), DCD+	<—
J1-6	DCD/DCD–	J2-10	CF(B), DCD–	<—
J1-24	TxC/RxC+	J2-15	DB(A), TxC+	<—
J1-23	TxC/RxC–	J2-12	DB(B), TxC–	<—
J1-26	RxC/TxCE+	J2-17	DD(A), RxC+	<—
J1-25	RxC/TxCE–	J2-9	DD(B), RxC–	<—
J1-44	LL/DCD	J2-18	LL	—>
J1-45	Circuit_GND	J2-7	Circuit_ GND	–
J1-7	DTR/DSR+	J2-20	CD(A), DTR+	—>
J1-8	DTR/DSR–	J2-23	CD(B), DTR–	—>
J1-13	TxCE/TxC+	J2-24	DA(A), TxCE+	—>
J1-14	TxCE/TxC–	J2-11	DA(B), TxCE–	—>
J1-51	GND	—	—	Shorted
J1-52	MODE_DCE	—	—	

1. The EIA-530 interface operates in DTE mode only. A DCE cable is not available for the EIA-530 interface.

EIA/TIA-232

Figure C-7 shows the EIA/TIA-232 cable assembly. Table C-7 lists the DTE pinouts. Table C-8 lists the DCE pinouts. Arrows indicate signal direction: —> indicates DTE to DCE, and <— indicates DCE to DTE.

Figure C-7 EIA/TIA-232 Cable Assembly

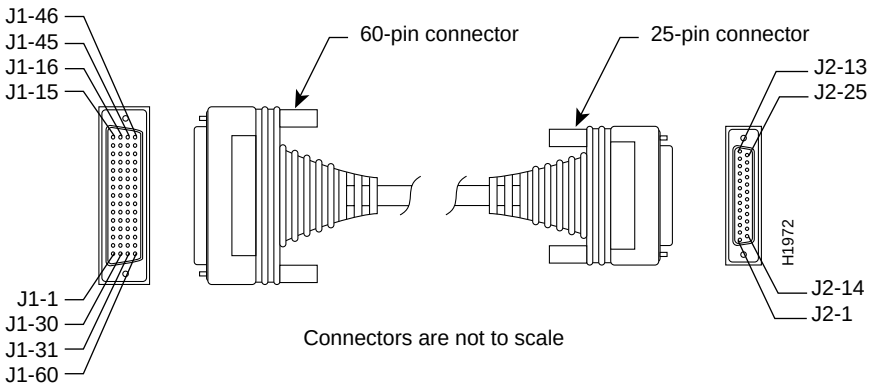


Table C-7 EIA/TIA-232 DTE Cable Pinouts (DB-60 to DB-25)

60 Pin	Signal	Description	Direction	25 Pin	Signal
J1-50	MODE_0	Shorting group	–	–	–
J1-51	GND				
J1-52	MODE_DCE				
J1-46	Shield GND	Single	–	J2-1	Shield GND
J1-41	TxD/RxD	Twisted pair no. 5	—>	J2-2	TxD
Shield	–		–	Shield	–

Table C-7 EIA/TIA-232 DTE Cable Pinouts (DB-60 to DB-25) (Continued)

60 Pin	Signal	Description	Direction	25 Pin	Signal
J1-36	RxD/TxD	Twisted pair no. 9	<—	J2-3	RxD
Shield	–		–	Shield	–
J1-42	RTS/CTS	Twisted pair no. 4	—>	J2-4	RTS
Shield	–		–	Shield	–
J1-35	CTS/RTS	Twisted pair no. 10	<—	J2-5	CTS
Shield	–		–	Shield	–
J1-34	DSR/DTR	Twisted pair no. 11	<—	J2-6	DSR
Shield	–		–	Shield	–
J1-45	Circuit GND	Twisted pair no. 1	–	J2-7	Circuit GND
Shield	–		–	Shield	–
J1-33	DCD/LL	Twisted pair no. 12	<—	J2-8	DCD
Shield	–		–	Shield	–
J1-37	TxC/NIL	Twisted pair no. 8	<—	J2-15	TxC
Shield	–		–	Shield	–
J1-38	RxC/TxCE	Twisted pair no. 7	<—	J2-17	RxC
Shield	–		–	Shield	–
J1-44	LL/DCD	Twisted pair no. 2	—>	J2-18	LTST
Shield	–		–	Shield	–
J1-43	DTR/DSR	Twisted pair no. 3	—>	J2-20	DTR
Shield	–		–	Shield	–
J1-39	TxCE/TxC	Twisted pair no. 6	—>	J2-24	TxCE
Shield	–		–	Shield	–

Table C-8 EIA/TIA-232 DCE Cable Pinouts (DB-60 to DB-25)

60 Pin	Signal	Description	Direction	25 Pin	Signal
J1-50	MODE_0	Shorting group	–	–	–
J1-51	GND				
J1-46	Shield GND	Single	–	J2-1	Shield GND
J1-36	RxD/TxD	Twisted pair no. 9	<—	J2-2	TxD
Shield	–		–	Shield	–
J1-41	TxD/RxD	Twisted pair no. 5	—>	J2-3	RxD
Shield	–		–	Shield	–
J1-35	CTS/RTS	Twisted pair no. 10	<—	J2-4	RTS
Shield	–		–	Shield	–
J1-42	RTS/CTS	Twisted pair no. 4	—>	J2-5	CTS
Shield	–		–	Shield	–
J1-43	DTR/DSR	Twisted pair no. 3	—>	J2-6	DSR
Shield	–		–	Shield	–
J1-45	Circuit GND	Twisted pair no. 1	–	J2-7	Circuit GND
Shield	–		–	Shield	
J1-44	LL/DCD	Twisted pair no. 2	—>	J2-8	DCD
Shield	–		–	Shield	–
J1-39	TxCE/TxC	Twisted pair no. 7	—>	J2-15	TxC
Shield	–		–	Shield	–
J1-40	NIL/RxC	Twisted pair no. 6	—>	J2-17	RxC
Shield	–		–	Shield	–
J1-33	DCD/LL	Twisted pair no. 12	<—	J2-18	LTST
Shield	–		–	Shield	–

Table C-8 EIA/TIA-232 DCE Cable Pinouts (DB-60 to DB-25) (Continued)

60 Pin	Signal	Description	Direction	25 Pin	Signal
J1-34	DSR/DTR	Twisted pair no. 11	<—	J2-20	DTR
Shield	–		–	Shield	–
J1-38	RxC/TxCE	Twisted pair no. 8	<—	J2-24	TxCE
Shield	–		–	Shield	–

EIA/TIA-449

Figure C-8 shows the EIA/TIA-449 cable assembly. Table C-9 lists the DTE pinouts. Table C-10 lists the DCE pinouts. Arrows indicate signal direction: —> indicates DTE to DCE, and <— indicates DCE to DTE.

Figure C-8 EIA/TIA-449 Cable Assembly

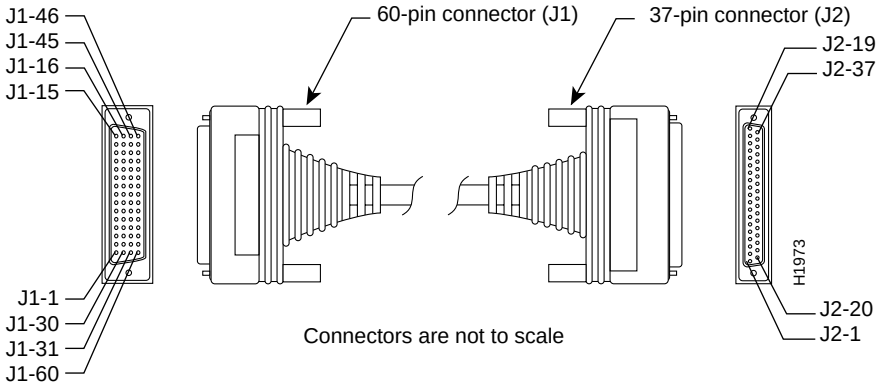


Table C-9 EIA/TIA-449 DTE Cable Pinouts (DB-60 to DB-37)

60 Pin	Signal	Description	Direction	37 Pin	Signal
J1-49	MODE_1	Shorting group	–	–	–
J1-48	GND				
J1-51	GND	Shorting group	–	–	–
J1-52	MODE_DCE				
J1-46	Shield_GND	Single	_	J2-1	Shield GND
J1-11	TxD/RxD+	Twisted pair no. 6	—>	J2-4	SD+
J1-12	TxD/RxD–		—>	J2-22	SD–
J1-24	TxC/RxC+	Twisted pair no. 9	<—	J2-5	ST+
J1-23	TxC/RxC–		<—	J2-23	ST–
J1-28	RxD/TxD+	Twisted pair no. 11	<—	J2-6	RD+
J1-27	RxD/TxD–		<—	J2-24	RD–
J1-9	RTS/CTS+	Twisted pair no. 5	—>	J2-7	RS+
J1-10	RTS/CTS–		—>	J2-25	RS–
J1-26	RxC/TxCE+	Twisted pair no. 10	<—	J2-8	RT+
J1-25	RxC/TxCE–		<—	J2-26	RT–
J1-1	CTS/RTS+	Twisted pair no. 1	<—	J2-9	CS+
J1-2	CTS/RTS–		<—	J2-27	CS–
J1-44	LL/DCD	Twisted pair no. 12	—>	J2-10	LL
J1-45	Circuit_GND		_	J2-37	SC
J1-3	DSR/DTR+	Twisted pair no. 2	<—	J2-11	DM+
J1-4	DSR/DTR–		<—	J2-29	DM–
J1-7	DTR/DSR+	Twisted pair no. 4	—>	J2-12	TR+
J1-8	DTR/DSR–		—>	J2-30	TR–
J1-5	DCD/DCD+	Twisted pair no. 3	<—	J2-13	RR+
J1-6	DCD/DCD–		<—	J2-31	RR–

Table C-9 EIA/TIA-449 DTE Cable Pinouts (DB-60 to DB-37) (Continued)

60 Pin	Signal	Description	Direction	37 Pin	Signal
J1-13	TxCE/TxC+	Twisted pair no. 7	—>	J2-17	TT+
J1-14	TxCE/TxC–		—>	J2-35	TT–
J1-15	Circuit_GND	Twisted pair no. 9	–	J2-19	SG
J1-16	Circuit_GND		–	J2-20	RC

Table C-10 EIA/TIA-449 DCE Cable Pinouts (DB-60 to DB-37)

60 Pin	Signal	Description	Direction	37 Pin	Signal
J1-49	MODE_1	Shorting group	–	–	–
J1-48	GND				
J1-46	Shield_GND	Single	–	J2-1	Shield GND
J1-28	RxD/TxD+	Twisted pair no. 11	<—	J2-4	SD+
J1-27	RxD/TxD–		<—	J2-22	SD–
J1-13	TxCE/TxC+	Twisted pair no. 7	—>	J2-5	ST+
J1-14	TxCE/TxC–		—>	J2-23	ST–
J1-11	TxD/RxD+	Twisted pair no. 6	—>	J2-6	RD+
J1-12	TxD/RxD–		—>	J2-24	RD–
J1-1	CTS/RTS+	Twisted pair no. 1	<—	J2-7	RS+
J1-2	CTS/RTS–		<—	J2-25	RS–
J1-24	TxC/RxC+	Twisted pair no. 9	—>	J2-8	RT+
J1-23	TxC/RxC–		—>	J2-26	RT–
J1-9	RTS/CTS+	Twisted pair no. 5	—>	J2-9	CS+
J1-10	RTS/CTS–		—>	J2-27	CS–
J1-29	NIL/LL	Twisted pair no. 12	—>	J2-10	LL
J1-30	Circuit_GND		–	J2-37	SC

Table C-10 EIA/TIA-449 DCE Cable Pinouts (DB-60 to DB-37) (Continued)

60 Pin	Signal	Description	Direction	37 Pin	Signal
J1-7	DTR/DSR+	Twisted pair no. 4	—>	J2-11	DM+
J1-8	DTR/DSR–		—>	J2-29	DM–
J1-3	DSR/DTR+	Twisted pair no. 2	<—	J2-12	TR+
J1-4	DSR/DTR–		<—	J2-30	TR–
J1-5	DCD/DCD+	Twisted pair no. 3	—>	J2-13	RR+
J1-6	DCD/DCD–		—>	J2-31	RR–
J1-26	RxC/TxCE+	Twisted pair no. 10	<—	J2-17	TT+
J1-25	RxC/TxCE–		<—	J2-35	TT–
J1-15	Circuit_GND	Twisted pair no. 8	_	J2-19	SG
J1-16	Circuit_GND		_	J2-20	RC

V.35

Figure C-9 shows the V.35 cable assembly. Table C-11 lists the DTE pinouts. Table C-12 lists the DCE pinouts. Arrows indicate signal direction: —> indicates DTE to DCE, and <— indicates DCE to DTE.

Figure C-9 V.35 Cable Assembly

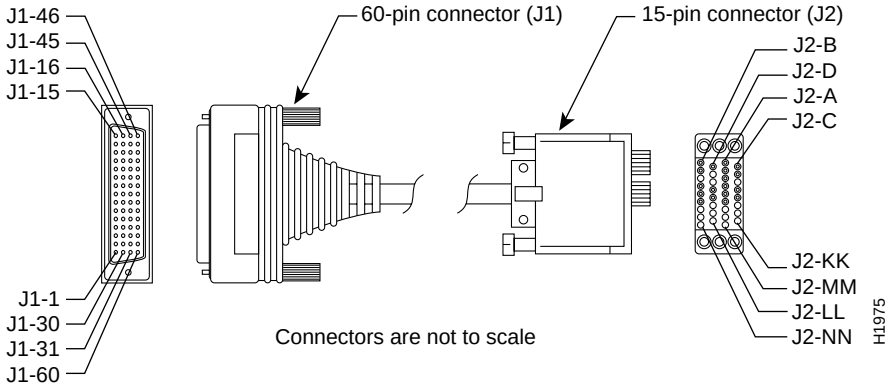


Table C-11 V.35 DTE Cable Pinouts (DB-60 to 34-Pin)

60 Pin	Signal	Description	Direction	34 Pin	Signal
J1-49	MODE_1	Shorting group	–	–	–
J1-48	GND				
J1-50	MODE_0	Shorting group	–	–	–
J1-51	GND				
J1-52	MODE_DCE				
J1-53	TxC/NIL	Shorting group	–	–	–
J1-54	RxC_TxCE				
J1-55	RxD/TxD				
J1-56	GND				
J1-46	Shield_GND	Single	–	J2-A	Frame GND
J1-45	Circuit_GND	Twisted pair no. 12	–	J2-B	Circuit GND
Shield	–		–	Shield	–
J1-42	RTS/CTS	Twisted pair no. 9	—>	J2-C	RTS
Shield	–		–	Shield	–

Table C-11 V.35 DTE Cable Pinouts (DB-60 to 34-Pin) (Continued)

60 Pin	Signal	Description	Direction	34 Pin	Signal
J1-35	CTS/RTS	Twisted pair no. 8	<—	J2-D	CTS
Shield	–		–	Shield	–
J1-34	DSR/DTR	Twisted pair no. 7	<—	J2-E	DSR
Shield	–		–	Shield	–
J1-33	DCD/LL	Twisted pair no. 6	<—	J2-F	RLSD
Shield	–		–	Shield	–
J1-43	DTR/DSR	Twisted pair no. 10	—>	J2-H	DTR
Shield	–		–	Shield	–
J1-44	LL/DCD	Twisted pair no. 11	—>	J2-K	LT
Shield	–		–	Shield	–
J1-18	TxD/RxD+	Twisted pair no. 1	—>	J2-P	SD+
J1-17	TxD/RxD–		—>	J2-S	SD–
J1-28	RxD/TxD+	Twisted pair no. 5	<—	J2-R	RD+
J1-27	RxD/TxD–		<—	J2-T	RD–
J1-20	TxCE/TxC+	Twisted pair no. 2	—>	J2-U	SCTE+
J1-19	TxCE/TxC–		—>	J2-W	SCTE–
J1-26	RxC/TxCE+	Twisted pair no. 4	<—	J2-V	SCR+
J1-25	RxC/TxCE–		<—	J2-X	SCR–
J1-24	TxC/RxC+	Twisted pair no. 3	<—	J2-Y	SCT+
J1-23	TxC/RxC–		<—	J2-AA	SCT–

Table C-12 V.35 DCE Cable Pinouts (DB-60 to 34-Pin)

60 Pin	Signal	Description	Direction	34 Pin	Signal
J1-49	MODE_1	Shorting group	–	–	–
J1-48	GND				

Table C-12 V.35 DCE Cable Pinouts (DB-60 to 34-Pin) (Continued)

60 Pin	Signal	Description	Direction	34 Pin	Signal
J1-50	MODE_0	Shorting group	–	–	–
J1-51	GND				
J1-53	TxC/NIL	Shorting group	–	–	–
J1-54	RxC_TxCE				
J1-55	RxD/TxD				
J1-56	GND				
J1-46	Shield_GND	Single	–	J2-A	Frame GND
J1-45	Circuit_GND	Twisted pair no. 12	–	J2-B	Circuit GND
Shield	–		–	Shield	–
J1-35	CTS/RTS	Twisted pair no. 8	<—	J2-C	RTS
Shield	–		–	Shield	–
J1-42	RTS/CTS	Twisted pair no. 9	—>	J2-D	CTS
Shield	–		–	Shield	–
J1-43	DTR/DSR	Twisted pair no. 10	—>	J2-E	DSR
Shield	–		–	Shield	–
J1-44	LL/DCD	Twisted pair no. 11	—>	J2-F	RLSD
Shield	–		–	Shield	–
J1-34	DSR/DTR	Twisted pair no. 7	<—	J2-H	DTR
Shield	–		–	Shield	–
J1-33	DCD/LL	Twisted pair no. 6	<—	J2-K	LT
Shield	–		–	Shield	–
J1-28	RxD/TxD+	Twisted pair no. 5	<—	J2-P	SD+
J1-27	RxD/TxD–		<—	J2-S	SD–
J1-18	TxD/RxD+	Twisted pair no. 1	—>	J2-R	RD+
J1-17	TxD/RxD–		—>	J2-T	RD–
J1-26	RxC/TxCE+	Twisted pair no. 4	<—	J2-U	SCTE+
J1-25	RxC/TxCE–		<—	J2-W	SCTE–

Table C-12 V.35 DCE Cable Pinouts (DB-60 to 34-Pin) (Continued)

60 Pin	Signal	Description	Direction	34 Pin	Signal
J1-22	NIL/RxC+	Twisted pair no. 3	—>	J2-V	SCR+
J1-21	NIL/RxC–		—>	J2-X	SCR–
J1-20	TxCE/TxC+	Twisted pair no. 2	—>	J2-Y	SCT+
J1-19	TxCE/TxC–		—>	J2-AA	SCT–

X.21

Figure C-10 shows the X.21 cable assembly. Table C-13 lists the DTE pinouts. Table C-14 lists the DCE pinouts. Arrows indicate signal direction: —> indicates DTE to DCE, and <— indicates DCE to DTE.

Figure C-10 X.21 Cable Assembly

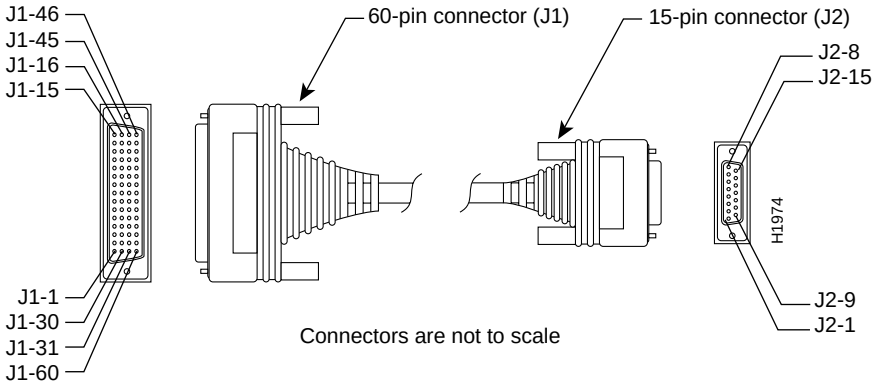


Table C-13 X.21 DTE Cable Pinouts (DB-60 to DB-15)

60 Pin	Signal	Description	Direction	15 Pin	Signal
J1-48	GND	Shorting group	–	–	–
J1-47	MODE_2				
J1-51	GND	Shorting group	–	–	–
J1-52	MODE_DCE				
J1-46	Shield_GND	Single	–	J2-1	Shield GND
J1-11	TxD/RxD+	Twisted pair no. 3	—>	J2-2	Transmit+
J1-12	TxD/RxD–		—>	J2-9	Transmit–

Table C-13 X.21 DTE Cable Pinouts (DB-60 to DB-15) (Continued)

60 Pin	Signal	Description	Direction	15 Pin	Signal
J1-9	RTS/CTS+	Twisted pair no. 2	—>	J2-3	Control+
J1-10	RTS/CTS–		—>	J2-10	Control–
J1-28	RxD/TxD+	Twisted pair no. 6	<—	J2-4	Receive+
J1-27	RxD/TxD–		<—	J2-11	Receive–
J1-1	CTS/RTS+	Twisted pair no. 1	<—	J2-5	Indication+
J1-2	CTS/RTS–		<—	J2-12	Indication–
J1-26	RxC/TxCE+	Twisted pair no. 5	<—	J2-6	Timing+
J1-25	RxC/TxCE–		<—	J2-13	Timing–
J1-15	Control_GND	Twisted pair no. 4	–	J2-8	Control GND
Shield	–		–	Shield	–

Table C-14 X.21 DCE Cable Pinouts (DB-60 to DB-15)

60 Pin	Signal	Description	Direction	15 Pin	Signal
J1-48	GND	Shorting group	–	–	–
J1-47	MODE_2				
J1-46	Shield_GND	Single	–	J2-1	Shield GND
J1-28	RxD/TxD+	Twisted pair no. 6	<—	J2-2	Transmit+
J1-27	RxD/TxD–		<—	J2-9	Transmit–
J1-1	CTS/RTS+	Twisted pair no. 1	<—	J2-3	Control+
J1-2	CTS/RTS–		<—	J2-10	Control–
J1-11	TxD/RxD+	Twisted pair no. 3	—>	J2-4	Receive+
J1-12	TxD/RxD–		—>	J2-11	Receive–
J1-9	RTS/CTS+	Twisted pair no. 2	—>	J2-5	Indication+
J1-10	RTS/CTS–		—>	J2-12	Indication–

Table C-14 X.21 DCE Cable Pinouts (DB-60 to DB-15) (Continued)

60 Pin	Signal	Description	Direction	15 Pin	Signal
J1-24	TxC/RxC+	Twisted pair no. 4	—>	J2-6	Timing+
J1-23	TxC/RxC–		—>	J2-13	Timing–
J1-15	Control_GND	Twisted pair no. 5	–	J2-8	Control GND
Shield	–		–	Shield	–

ISDN BRI Port and Cable Pinouts

Table C-15 lists the ISDN BRI port pinouts. The straight-through RJ-45-to-RJ-45 cable, used to connect to the ISDN BRI port, is not included.

Table C-15 BRI Port (RJ-45) Pinouts

RJ-45 8 Pin[1]	TE[2]	NT[3]	Polarity
3	Transmit	Receive	+
4	Receive	Transmit	+
5	Receive	Transmit	–
6	Transmit	Receive	–

1. Pins 1, 2, 7, and 8 are not used.
2. TE refers to terminal terminating layer 1 aspects of TE1, TA, and NT2 functional groups.
3. NT refers to network terminating layer 1 aspects of NT1 and NT2 functional groups.

CHAPTER 2

Preparing to Install the Cisco Multiport Serial Routers

This chapter describes the tasks you must perform before you begin to install the Cisco 2500 series multiport serial routers. It includes the following sections:

- Safety Recommendations
- General Site Requirements
- Prerequisites for System Operation
- Installation Checklist
- Creating a Site Log
- Cabling Considerations
- Console and Auxiliary Port Considerations
- Network Connection Considerations
- Inspecting the System

Safety Recommendations

Follow these guidelines to ensure general safety:

- Keep the chassis area clear and dust-free during and after installation.
- Put the removed chassis cover in a safe place.
- Keep tools away from walk areas where you and others could fall over them.
- Do not wear loose clothing that could get caught in the chassis. Fasten your tie or scarf and roll up your sleeves.

- Wear safety glasses if you are working under any conditions that might be hazardous to your eyes.
- Do not perform any action that creates a potential hazard to people or makes the equipment unsafe.

Maintaining Safety with Electricity

Follow these guidelines when working on equipment powered by electricity.

Warning Before working on equipment that is connected to power lines, remove jewelry (including rings, necklaces, and watches). Metal objects will heat up when connected to power and ground and can cause serious burns or can weld the metal object to the terminals. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

- Locate the emergency power-off switch for the room in which you are working. Then, if an electrical accident occurs, you can act quickly to turn off the power.
- Disconnect all power by turning off the power and unplugging the power cord before doing the following:
  - Installing or removing a chassis
  - Working near power supplies
- Do not work alone if potentially hazardous conditions exist.
- Never assume that power is disconnected from a circuit. Always check.

Warning Read the installation instructions before you connect the system to its power source. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

- Look carefully for possible hazards in your work area, such as moist floors, ungrounded power extension cables, frayed power cords, and missing safety grounds.
- If an electrical accident occurs, proceed as follows:
  - Use caution; do not become a victim yourself.
  - Turn off power to the system.
  - If possible, send another person to get medical aid. Otherwise, assess the condition of the victim and then call for help.
  - Determine if the person needs rescue breathing or external cardiac compressions; then take appropriate action.

Preventing Electrostatic Discharge Damage

Electrostatic discharge (ESD) can damage equipment and impair electrical circuitry. It occurs when electronic components are improperly handled and can result in complete or intermittent failures.

Always follow ESD-prevention procedures when removing and replacing components. Ensure that the chassis is electrically connected to earth ground. Wear an ESD-preventive wrist strap, ensuring that it makes good skin contact. Connect the clip to an unpainted surface of the chassis frame to safely channel unwanted ESD voltages to ground. To properly guard against ESD damage and shocks, the wrist strap and cord must operate effectively. If no wrist strap is available, ground yourself by touching the metal part of the chassis.

Caution For safety, periodically check the resistance value of the antistatic strap, which should be between 1 and 10 megohms.

General Site Requirements

This section describes the requirements your site must meet for safe installation and operation of your system. Ensure that your site is properly prepared before beginning installation.

The multiport serial routers can be placed on a desktop or mounted in a rack or on a wall.

Warning Ultimate disposal of this product should be handled according to all national laws and regulations. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

Site Environment

The location of individual chassis and the layout of your equipment rack or wiring room are extremely important for proper system operation. Equipment placed too close together, inadequate ventilation, and inaccessible panels can cause system malfunctions and shutdowns, and can make system maintenance difficult.

When planning your site layout and equipment locations, keep in mind the precautions described in the next section, "Preventive Site Configuration," to help avoid equipment failures and reduce the possibility of environmentally caused shutdowns. If you are currently experiencing shutdowns or unusually high errors with your existing equipment, these precautions may help you isolate the cause of failures and prevent future problems.

Preventive Site Configuration

The following precautions will help you plan an acceptable operating environment for your multiport serial router and will help you avoid environmentally caused equipment failures:

- Electrical equipment generates heat. Ambient air temperature might not be adequate to cool equipment to acceptable operating temperatures without adequate circulation. Ensure that the room in which you operate your system has adequate air circulation.
- Always follow the ESD-prevention procedures described in the section "Safety Recommendations" earlier in this chapter to avoid damage to equipment. Damage from static discharge can cause immediate or intermittent equipment failure.
- Ensure that the chassis cover is secure. The chassis is designed to allow cooling air to flow effectively within it. An open chassis allows air leaks, which may interrupt and redirect the flow of cooling air from internal components.

Configuring Equipment Racks

The following tips will help you plan an acceptable equipment rack configuration:

- Enclosed racks must have adequate ventilation. Ensure that the rack is not overly congested because each unit generates heat. An enclosed rack should have louvered sides and a fan to provide cooling air.
- When mounting a chassis in an open rack, ensure that the rack frame does not block the intake or the exhaust ports. If the chassis is installed on slides, check the position of the chassis when it is seated all the way into the rack.
- In an enclosed rack with a ventilation fan in the top, excessive heat generated by equipment near the bottom of the rack can be drawn upward and into the intake ports of the equipment above it in the rack.
- Baffles can help to isolate exhaust air from intake air, which also helps to draw cooling air through the chassis. The best placement of the baffles depends on the airflow patterns in the rack, which are found by experimenting with different arrangements.

Power Supply Considerations

Check the power at your site to ensure that you are receiving "clean" power (free of spikes and noise). Install a power conditioner if necessary.

Warning The device is designed to work with TN power systems. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

The multiport serial router power supply includes the following features:

- Autoselects either 110V or 220V operation.
- All units include a 6-foot (1.8-meter) electrical power cord. (A label near the power cord indicates the correct voltage, frequency, current draw, and power dissipation for your unit.)

Warning This product relies on the building's installation for short-circuit (overcurrent) protection. Ensure that a fuse or circuit breaker no larger than 120 VAC, 15A U.S. (240 VAC, 10A international) is used on the phase conductors (all current-carrying conductors). (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

Prerequisites for System Operation

The multiport serial routers run system code from Flash memory single in-line memory modules (SIMMs). With the proper system code image, the multiport serial router can also run from dynamic random-access memory (DRAM); however, this operation requires a 4-MB memory upgrade (installation of a 1 MB x 36 DRAM SIMM). In addition, operating system code from DRAM can result in a 25 percent decrease in system performance.

Operating the system code from Flash memory is the default and is recommended for optimum performance of the multiport serial routers.

Installation Checklist

The Installation Checklist lists the procedures for initial hardware installation of a new multiport serial router. Make a copy of this checklist and mark the entries as you complete each procedure. Include a copy of the checklist for each system in your Site Log. (See the following section, “Creating a Site Log.”)

Installation checklist for site_____

Router name_____

Task	Verified by	Date
Installation checklist copied		
Background information placed in Site Log		
Site power voltages verified		
Required tools available		
Additional equipment available		
Router received		
Optional UniverCD or printed documentation received		
Chassis components verified		
Initial electrical connections established		
ASCII terminal or PC attached to console port		
Signal distance limits verified		
Startup sequence steps completed		
Initial system operation verified		
Software image verified		

Creating a Site Log

The Site Log provides a record of all actions relevant to the system. Keep it near the chassis where anyone who performs tasks has access to it. Use the Installation Checklist (see the previous section "Installation Checklist") to verify steps in the installation and maintenance of your system. Site Log entries might include the following:

- Installation progress—Make a copy of the Installation Checklist and insert it into the Site Log. Make entries on the checklist as you complete each procedure.
- Upgrades and maintenance procedures—Use the Site Log as a record of ongoing system maintenance and expansion. Each time a procedure is performed on the system, update the Site Log to reflect the following:
  - Configuration changes
  - Changes and updates to Cisco IOS software
  - Maintenance schedules and requirements
  - Corrective maintenance procedures performed
  - Intermittent problems
  - Related comments and notes

Cabling Considerations

When setting up your multiport serial router, consider distance limitations and potential electromagnetic interference (EMI) as defined by the Electronic Industries Association (EIA).

Warning The ports labeled "Ethernet," "10BaseT," "Token Ring," "Console," and "AUX" are safety extra-low voltage (SELV) circuits. SELV circuits should only be connected to other SELV circuits. Because the BRI circuits are treated like telephone-network voltage, avoid connecting the SELV circuit to the telephone network voltage (TNV) circuits. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

Distance Limitations

Following are the distance limitation specifications for Ethernet, Token Ring, and serial interfaces.

Ethernet Connections

The distance limitations for the IEEE 802.3 (10Base5 coaxial cable) specification indicate a maximum segment distance of 1,640 feet (500 m) at a transmission rate of 10 megabits per second (Mbps).

The distance limitations for Ethernet 10BaseT indicate a maximum segment distance of 328 feet (100 m); Ethernet 10Base2 has a maximum segment distance of 606 feet (185 m).

Token Ring Connections

The distance limitations for the IEEE 802.5 specification indicate a maximum segment distance of 328 feet (100 m) at a transmission rate of 4 or 16 Mbps for unshielded twisted-pair (UTP) cable. The distance limitation when using shielded twisted-pair (STP) cabling is 1,640 feet (500 m).

Serial Connections

As with all signaling systems, EIA/TIA-232 signals can travel a limited distance at any given bit rate; generally, the slower the data rate, the greater the distance. Table 2-1 shows the standard relationship between baud rate and maximum distance.

Table 2-1 EIA/TIA-232 Speed and Distance Limitations

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
2400	200	60
4800	100	30
9600	50	15
19200	50	15

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
38400	50	15
57600	25	7.6
115200	12	3.7

The use of balanced drivers allows EIA/TIA-449 signals to travel greater distances than the EIA/TIA-232 standard. Table 2-2 lists the standard relationship between baud rate and maximum distance for EIA/TIA-449 signals. These limits are also valid for V.35 and X.21.

Table 2-2 EIA/TIA-449 Speed and Distance Limitations

Data Rate (Baud)	Distance (Feet)	Distance (Meters)
2400	4,100	1,250
4800	2,050	625
9600	1,025	312
19200	513	156
38400	256	78
56000	102	31
T1	50	15

Caution The EIA/TIA-449 and V.35 interfaces support data rates up to 2.048 Mbps. Exceeding this maximum could result in loss of data and is not recommended.

Console and Auxiliary Port Considerations

This section discusses important cabling information that must be considered before you connect the terminals or modems to console and auxiliary ports. The console port and the auxiliary port are used to provide access to the system either locally or remotely.

Console Port Connections

Each multiport serial router includes an EIA/TIA-232 (RJ-45) console asynchronous serial port. This port connects to a terminal using an RJ-45 cable and an RJ-45-to-DB-25 adapter or a PC using the RJ-45 to DB-9 adapter. Depending on the cable and the adapter used, this port appears as a data terminal equipment (DTE) or data communications equipment (DCE) device at the end of the cable. To connect to a terminal, use an RJ-45 roll-over cable with a female DTE connector (labeled Terminal) for connection to the console port. For detailed information on installing the terminal, see the section “Connecting to the Console Port” in the chapter “Installing the Cisco Multiport Serial Routers.”)

Table B-1 in the appendix “Cisco Multiport Router Cable Specifications” lists the pinout for the console port. The default parameters for the console port are 9600 baud, 8 data bits, no parity, and 2 stop bits. The console port does not support hardware flow control or modem control.

Auxiliary Port Connections

An EIA/TIA-232 (RJ-45) auxiliary asynchronous serial port is included on all multiport serial routers. This port can connect to a modem for remote maintenance or terminal services. Use an RJ-45 roll-over cable with a male modem (MMOD) adapter (labeled Modem) for this connection. For detailed information on connecting devices to the auxiliary port, see the section “Connecting a Modem to the Auxiliary Port” in the chapter “Installing the Cisco Multiport Serial Routers.” See Table B-1 in the appendix “Cisco Multiport Router Cable Specifications” for the pinout for the auxiliary port.

Network Connection Considerations

This sections describes important cabling information that must be considered before making your network connections. The Ethernet or Token Ring ports are used to connect to a LAN; the synchronous serial ports are used to connect to a WAN; and the asynchronous ports are used to provide remote access to the multiport serial routers.

Ethernet Connections

The Ethernet ports are located on the rear panel of the Cisco 2520 (labeled ETHERNET 0 AUI and UTP) and Cisco 2522 (labeled ETHERNET 0 AUI and 10BT) multiport serial routers. Both ports are active, but only one can be used at a time. If both ports are connected, the 10BaseT port is active.Use an Ethernet transceiver to connect multiport serial routers directly to the network.

You can use the following equipment to connect to the Ethernet AUI port:

- An Ethernet AUI cable connected to a transceiver
- An Ethernet transceiver connected directly to the multiport serial router's AUI port

The connection to the AUI port can be made using either slide latch connectors or jackscrew connectors

Note Ethernet cables are not shipped as standard with the multiport serial routers.

The 10BaseT port is connected to the Ethernet through the twisted-pair wiring, and is modular in design.

Token Ring Connections

The two Token Ring ports are located on the rear panel of the Cisco 2521 and Cisco 2523 and are labeled TOKEN RING or UTP. The port labeled TOKEN RING uses a standard 9-pin Token Ring lobe cable and connects the multiport serial router directly to a media

attachment unit (MAU). The Token Ring port labeled UTP uses an RJ-45 Token Ring cable and is connected through an adapter or directly to a MAU. Only one Token Ring port can be used at a time.

Synchronous Serial Connections

The multiport serial routers offer two high-speed synchronous serial ports and from two to eight (depending on which chassis you have) low-speed asynchronous/synchronous serial interface ports that can be configured as synchronous serial interfaces.

The high-speed synchronous serial ports are located on the left of the rear panel and are labeled SERIAL 0 and SERIAL 1.

The serial ports are 60-pin, D-type connectors. All serial interfaces (except the EIA-530) can be configured as DTE or DCE, depending on the attached cable. The EIA-530 interface is only configured as DTE. All DTE serial ports require that external clocking be provided by a channel service unit/data service unit (CSU/DSU) or other DCE device.

You must use a special serial cable to connect a multiport serial router to a modem or CSU/DSU. This cable is available from Cisco and is usually ordered with the system. The cable uses a DB-60 connector on the chassis end. See the appendix "Cisco Multiport Router Cable Specifications" for cable pinouts. For ordering information, contact a customer service representative.

Note Because of the small size of the pins on the DB-60 serial connector, attempting to manufacture your own serial cables is not recommended.

Asynchronous/synchronous Serial Connections

The asynchronous/synchronous serial ports use the asynchronous/synchronous 60-pin connectors located on the rear panel. The lower ports are labeled SERIAL 2 (A/S) and SERIAL 3 (A/S): the upper ports (depending on which chassis you have) are labeled SERIAL 4 (A/S) through SERIAL 9 (A/S).

You must use a special serial cable to connect a multiport serial router to a modem or CSU/DSU. This cable is available from Cisco and is usually ordered with the system. The cable uses a DB-60 connector on the chassis end. See the appendix "Cisco Multiport Router Cable Specifications" for cable pinouts. For ordering information, contact a customer service representative.

BRI Connections

On models with a Basic Rate Interface (BRI) port, the BRI port is an RJ-45 8-pin connector located between the UTP and console ports on the Cisco 2520 and Cisco 2521, or between the 10BT and console ports on the Cisco 2522 and Cisco 2523. Use an appropriate cable to connect the system directly to the Integrated Services Digital Network (ISDN) through the NT1. The common carrier will provide the NT1 connection worldwide, except in North America, where the NT1 is customer owned.

Warning Network hazardous voltages are accessible in the BRI cable. If you detach the BRI cable, detach the end away from the multiport serial router first to avoid possible electric shock. Network hazardous voltages also are accessible on the system card in the area of the BRI port (RJ-45 connector), regardless of whether power is turned off. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

Warning The ISDN connection is regarded as a source of voltage that should be inaccessible to user contact. Do not attempt to tamper with or open any public telephone operator (PTO)-provided equipment or connection hardware. Any hardwired connection (other than by nonremovable, connect-one-time-only lug) must be made only by PTO staff or suitably trained engineers. (To see translated versions of this warning, refer to the appendix "Translated Safety Warnings.")

Inspecting the System

Do not unpack the multiport serial router until you are ready to install it. If the final installation site will not be ready for some time, keep the chassis in its shipping container to prevent accidental damage. When you have determined where you want the multiport serial router installed, proceed with the unpacking.

The multiport serial router, cables, UniverCD or printed publications, and any optional equipment you ordered might be shipped in more than one container. When you unpack each shipping container, check the packing list to ensure that you received the following items:

- Multiport serial router
- 6-foot (1.8-meter) power cord
- Jackscrews for the AUI connector
- Console and auxiliary cabling kit (two RJ-45 roll-over cables, one terminal adapter, one DB-9 PC adapter, and one modem adapter)
- Optional equipment (such as network interface cables and asynchronous breakout cables)
- *Cisco Information Packet* publication, UniverCD and optional printed publications, as specified on your order

Inspect all items for shipping damage. If anything appears to be damaged, or if you encounter problems when installing or configuring your system, contact a customer service representative.